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ASTM BULLETIN

"Promotion of Knowledge of Materials of Engineering, and Standardization of Specifications and Methods of Testing"

TELEPHONE—PENnypacker 3545 | R. E. Hess, Editor | R. J. Painter, Associate Editor | CABLE ADDRESS—TESTING

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Society to Extend Its Standardization Activities in Field of Ultimate Consumer Goods

New Administrative Committee Given Responsibility for Planning and Directing Work

UNDER a policy recently adopted by the Executive Committee, the Society will extend its present work in the preparation of standard tests and specifications for ultimate consumer goods, and will place in the hands of a new administrative committee the responsibility for planning and directing the development of this program through extension of present committee activities and when advisable through the establishment of new committees. The demand for the development and use of standard specifications and methods of test for ultimate consumer goods and the promotion of knowledge of materials for such goods has been growing rapidly in recent years, and has been reflected in the work of the Society in a number of fields, among the more important being textiles, soaps, rubber products, paper, plastics, fuels, paints, and various building materials.

Defining ultimate consumer goods as "materials or products which in the 'as is' condition are intended for sale to an individual purchaser for his personal property or use, and not for fabrication for resale," a special committee under the chairmanship of Vice-President Arthur W. Carpenter, The B. F. Goodrich Co., has carefully studied this subject in its relation to A.S.T.M. activities and has submitted a comprehensive report which the Executive Committee has adopted as a basis for action. Serving with Mr. Carpenter were Messrs. A. G. Ashcroft, Alexander Smith and Sons Carpet Co.; R. D. Bonney, Congoleum-Nairn, Inc.; T. A. Boyd, General Motors Corp.; A. L. Brassell, United States Testing Co., Inc.; Jules Labarthe, Jr., Mellon Institute of Industrial Research; G. C. MacDonald, Montgomery Ward & Co.; and H. H. Morgan, Robert W. Hunt Co. The committee's report appraises the extent and significance of the consumer movement, the activities of various agencies in this field including those of the Government, and the need for consumer goods standards in connection with labeling, grading, and certification plans. It expresses the belief that standardization in this field will become increasingly important and concludes that A.S.T.M. should enter that field within proper limitations.

It is intended that the Society's standardization work on ultimate consumer goods shall be based upon sound engineering principles and practices, and that it will deal only with such goods as permit of definitions, test data, and test limitations that can be measured by engineering methods. Work on assemblies of materials will be included only where evaluation of materials or workmanship is concerned, and it is not intended to engage in the formulation of design specifications. Left for later determination are such questions as whether the work should deal principally with manufacturing requirements intended to measure and maintain quality at a pre-determined level without emphasis on those factors dependent on human interest and use, or should aim to specify what will give consumer satisfaction at a minimum acceptable level. It is believed that the use factors must be considered; but since definite knowledge and actual test data concerning use characteristics are very limited in most cases of ultimate consumer goods, initial projects will necessarily deal with the development of test methods and specifications for specific uses of such goods concerning which knowledge can readily be obtained. Selection of such projects for reference to existing or new committees and the determination of procedures within the Society for developing consumer goods standards will be among the most important duties of the new administrative committee.

Included in the special committee's report are several important recommendations that the Executive Committee has referred to the administrative committee for implementation. Among these are the need for development of form, arrangement, and content of ultimate consumer goods standards and for statements for the guidance of committees in the development of such standards, possibly in the form of a Manual. Suggested clauses have been formulated for inclusion in such standards that will clearly define the applicability and possible use limitations of the standard, and that will disclaim responsibility of the Society as such for representations such as labeling, certification, and

advertising based upon the standards. Most significantly, the report discusses the most effective means of providing adequately for representation of the ultimate consumer on committees preparing standards for consumer goods and the adaptation of the present committee structure and procedure (developed largely for work with industrial goods) to the writing of consumer goods standards. The Society's cardinal principle of balanced representation of producers, consumers, and general interest members on committees dealing with standards will be maintained, but the application of this principle to different committees may vary in detail in ways to be determined by the administrative committee.

The Executive Committee has authorized the administrative committee to initiate projects for reference to committees of the Society as well as to receive recommendations from those committees for work in the consumer goods field. It will have authority to recommend the organization of new committees in cases where the desired work cannot be handled by existing committees. The committee has also been directed to give careful consideration to the matter of maintaining equivalent standards for the same or similar products that are used both as industrial and ultimate consumer goods.

A rather extensive list of commodities for which standards are currently most frequently requested was prepared by the special committee and has been referred to the administrative committee. Conversely, the administrative committee may wish to exclude certain ultimate consumer goods from an A.S.T.M. program because of such considerations as existing Federal regulations, lack of interest in or demand for standards, or remoteness of connection with present activities of the Society. Such things as foods, drugs, and cosmetics seem to come within this category.

The successful development of standards in the ultimate consumer goods field will require more factual knowledge concerning the wants of consumers and more basic data on use values than are now available. Accordingly the Executive Committee, acting upon a recommendation of the special committee, is arranging for the establishment of a project within the Society for the development of techniques for obtaining knowledge of consumer wants and for accumulating data on which to base specifications and methods of test for ultimate consumer goods. This project will be an important aid in the implementation of the entire program and will necessarily utilize social, statistical, psychological, and economic approaches, in addition to those of science and engineering.

The Administrative Committee on Ultimate Consumer Goods will be headed by Herbert J. Ball, Professor of Textile Engineering, Lowell Textile Institute, Past-President of the Society and Chairman of Committee D-13 on Textile Materials. Professor Ball brings to this task an intimate knowledge of the Society's standardization work and administrative procedure, and familiarity with the conditions and special problems encountered in the development of standards for consumer goods. The personnel of the committee will be announced in the May BULLETIN, together with an account of the progress made at its first meeting, tentatively scheduled for the middle of April.

New Actions on Standards

Aviation Gasoline, Radiographic Terminology, Friction Tape, Refractory Materials

BY ACTION of Committee E-10 on Standards on items indicated in the accompanying list, a number of recommendations submitted by various standing committees have been approved.

Aviation Gasoline:

The revisions recommended by Committee D-2 in the Emergency Method of Test ES-45 covering Test for Olefins, Aromatics, and Naphthenes in Aviation Gasoline represent an improvement in the acid-treating procedure. These proposals were developed in Subcommittee XXV which covers the analysis of petroleum products for hydrocarbon types. The methods were orginally issued about two years ago but with restricted distribution to comply with the wishes of the War Department. Methods ES-46 covering test for benzene, toluene, and higher-boiling aromatics in aviation gasoline, also formerly distributed on a restricted basis (which restriction has now been removed), are published in Part III of the 1944 Book of Standards. As announced elsewhere in this BULLETIN Committee D-2 has other projects under way in this field and there is much activity on most phases of its work.

Friction Tape:

The Emergency Alternate Provisions EA-D 69a have been in effect for many months pertaining to the Standard Specifications for Friction Tape for General Use for Electrical Purposes (D 69-38). They have covered the production of a war emergency tape, but now with improvements in technique and with such materials as are now available it was apparent the quality could be improved, and the revisions in EA-D 69 provide for this. Consumers have been most anxious to get a better quality of tape and a series of discussions have been held in Committee D-11 toward this end. These latest Emergency Alternate Provisions D 69b are published in Part III of the Book of A.S.T.M. Standards. One change that pertains to wrapping of the tape will provide that either the tape or the carton shall be wrapped in a moisture-proof material and shall protect the material fully.

Radiographic Terminology:

There has been apparent for some time a need for some uniform system

of terms for use in referring to the images of discontinuities which appear on radiographs, and Committee E-7 on Radiographic Testing has been at work developing a terminology that would be of assistance to foundrymen, metallographers, and radiologists generally. The committee discussed the proposals at several meetings and they have recently been accepted by Committee E-10. While not perfect the committee feels that the system should be very helpful. The terminology is presented in seven divisions, as follows: gas holes, shrinkage, heterogeneities, sharp discontinuities, miscellaneous, dispersed defects, and welds.

The Section on Gas Holes, for example, reads as follows:

"*Gas Holes*.—Appear as round or elongated, smooth-edged dark spots, occurring individually, in clusters, or distributed throughout the casting."

Under Sharp Discontinuities, Hot Cracks are described:

"*Hot Cracks*.—Appear as ragged dark lines of variable width and numerous branches. They have no definite line of continuity and may exist in groups. They may start at the surface or be internal."

Refractory Materials:

Of the nine recommendations involving work in the standards field being carried out by Committee C-8 on Refractories, four are new tentative methods; two give recognized procedures for thermal conductivity—one for general refractory materials, the other for fireclay refractories. The one on Thermal Conductivity of Fireclay Refractories (C 202 – 45 T) covers a new procedure that has been found satisfactory—this method supplements the general method C 201. Committee C-8 thought it best to have this general test method issued since subsequently the methods may be expanded to cover other types of material. The general method as issued covers equipment and procedure in close detail, but not the variations necessitated in evaluating individual types of refractory materials. The revised methods for thermal conductivity of insulating fire brick (C 162 – 45 T) also supplement the general methods C 201 in a similar manner to Method C 202.

A new Tentative Test for Bonding Strength of Air-Setting Refractory Mortars (Wet Type) (C 198 – 45 T) essentially covers the requirements now incorporated in the Specifications C 178 and issued with improvements. The new definition of air-setting refractory mortar takes care of a criticism that in the Standard Definition of Terms Relating to Refractories (C 71 – 42) the material on high-temperature bonding mortar was too general in nature. The tentative revision of definitions of fireclay plastic refractory in (C 71) also provides for a new definition for fireclay plastic refractory not heretofore covered, although the product is widely used and is covered by Specifications C 176. The two definitions follow:

Air-Setting Refractory Mortar.—A finely ground refractory material prepared in the wet or dry condition which, when tempered with the required amount of water, forms a mortar that will, upon drying, develop a strong air-set bond between refractory brick and maintain a bond when heated to furnace temperature.

Fireclay Plastic Refractory.—A fireclay material tempered with water and suitable for ramming into place to form a monolithic furnace lining that will attain satisfactory physical properties when subjected to the heat of furnace operation.

Recent Actions by Committee E-10 on Standards

NEW TENTATIVE STANDARDS

Methods of:

- Test for Bonding Strength of Air-Setting Refractory Mortars (Wet Type) (C 198 – 45 T)
- Test for Refractoriness of Air-Setting Refractory Mortars (Wet Type) (C 199 – 45 T)
- Test for Thermal Conductivity of Refractories (C 201 – 45 T)
- Test for Thermal Conductivity of Fireclay Refractories (C 202 – 45 T)
- Industrial Radiographic Terminology for Use in Connection with the Radiographic Inspection of Castings and Weldments (E 52 – 45 T)

REVISED TENTATIVE STANDARDS

Classification of:

- Insulating Back-Up Block and Insulating Fire Brick (C 155 – 45 T)

Specifications for:

- Air-Setting Refractory Mortar (Wet Type) for Boiler and Incinerator Service (C 178 – 45 T)

Method of:

- Test for Thermal Conductivity of Insulating Fire Brick (C 182 – 45 T)

TENTATIVE REVISION OF STANDARDS

Method of:

- Chemical Analysis of Refractory Materials (C 18 – 41)

Definition of Terms:

- Relating to Refractories (C 71 – 42)

REVISION OF EMERGENCY ALTERNATE PROVISION

Specifications for:

- EA – D 69b Friction Tape for General Use for Electrical Purposes (D 69 – 38)

REVISION OF EMERGENCY METHODS

Methods of:

- Test for Olefins, Aromatics, Paraffins, and Naphthenes in Aviation Gasoline (ES – 45a)

NEW EMERGENCY METHODS

- Emergency Air-Ignition Method for Determination of Sulfated Residue from Lubricating Oils (ES – 43)

Testing of Materials Parts and Assemblies in Actual or Simulated Service Conditions

Work to Expand Beyond Strictly Materials Testing

AT ITS meeting last June, the Executive Committee received a recommendation from the Special Study Committee (see ASTM BULLETIN No. 126, January, 1944, p. 37) that the Society "undertake actively the study, development, and standardization of methods of tests of parts and assemblies wherein the properties of materials are involved but not the establishment of design specifications or practices." The Executive Committee appointed a special committee under the chairmanship of Vice-President J. R. Townsend, Bell Telephone Laboratories, Inc., to explore this field and report its findings with recommendations. Appointed to serve with Mr. Townsend on this committee were the following: Rupen Eksergian, Edward G. Budd Manufacturing Co.; A. R. Ellis, Pittsburgh Testing Laboratory; J. M. Frankland, Chance Vought Aircraft Division of United Aircraft Corp.; Rear-Admiral C. A. Jones, U. S. Naval Experiment Station; D. E. Par-

sons, National Bureau of Standards; R. E. Peterson, Westinghouse Electric and Manufacturing Co.; Colonel S. B. Ritchie, Ordnance Dept., U. S. Army; L. P. Spalding, North American Aviation, Inc.; R. L. Templin, Aluminum Company of America; E. W. Upham, Chrysler Corp.; L. L. Wyman, General Electric Co.; and F. P. Zimmerli, Barnes-Gibson-Raymond Division of Associated Spring Corp.

This committee met at Society Headquarters in November and after an extensive discussion of the subject prepared the report abstracted below which was accepted by the Executive Committee at its January meeting as a basis for extension of the Society's work in the "standardization of methods of test of simple or composite materials in actual or simulated service conditions and environment." To implement the extension of this type of work in the Society and facilitate consideration of it with existing or new committees of the Society, the Executive Committee has authorized the appointment of an administrative committee which will be headed by L. L. Wyman, Research Metallurgist, Research Lab., General Electric Co., Schenectady, N. Y. The complete personnel of this committee, together with an account of its first meeting as scheduled for April, will appear in the next issue of the BULLETIN.

Report of Special Committee

TO THE EXECUTIVE COMMITTEE,
AMERICAN SOCIETY FOR TESTING MATERIALS

A meeting of the Special Committee on Testing of Parts and Assemblies was held at Society Headquarters on November 18, 1944. The committee respectfully submits the following recommendations:

It is considered that a proper function of the Society is to recommend methods of obtaining all the information about the materials that the designing engineer will need to make an informed design. In order to find out whether certain material properties are adequate, or, alternatively, to find out what material properties are needed, it appears necessary in testing to simulate more completely the conditions under which the final product must operate.

The committee recommends to the Executive Committee that A.S.T.M. undertake the study, development, and standardization of methods of test of simple or composite materials in actual or simulated service conditions and environment, in so far as performance has a bearing on the properties of the material. It is understood that this may involve the testing of processed parts under such conditions.

In transmitting the above recommendations, the Chairman submits the following supporting comments in behalf of the committee:

E. W. Upham, Chief Metallurgist, Chrysler Corporation, was the first to call the Society's attention to the need for enlarging the scope of its activities to include testing of parts and assemblies. Raw materials tests of themselves are not sufficient to fulfill the needs for modern engineering, where composite materials and processed structures are coming to the fore—a subject which touches not only the scope of activities of A.S.T.M. but that of other engineering societies as well. Accordingly, the present representative committee was invited to discuss the subject in a broad objective way from the point of view of the extent of interest in the testing of parts and assemblies, and whether A.S.T.M. should undertake work in this field.

It was the consensus of the committee that A.S.T.M. should undertake such work and that there was a proper region of activities where there would be no duplication of effort or conflict with the prerogatives of other societies.

Any study of a material must have in mind an application. The application involves how the "stuff" is to be shaped or used and the environmental conditions and service experience; so that the "thing" made of it will endure and perform with satisfaction. "Stuff" may be a single raw material or a composite material, such as reinforced concrete, plywood, impregnated textile, plated wire. The effect of the process on the quality of the finished part may be influenced by shape and proportion, as well as the way in which the process is controlled—for example, molded thermosetting parts, die castings, centrifugal castings, drawing, and so on.

The committee was of the opinion that environmental testing, such as salt spray, humidity, high and low temperature, impact, impact fatigue, vibration, and atmospheric exposure are definitely within the scope of the Society's activities. Many of these are already under investigation. The kind of materials should include composite materials, such as plywood, prefabricated building construction units, and welded, brazed, and soldered parts. In the field of fatigue testing the scope should be extended beyond simplified specimens to show the effect of notches and other surface irregularities. Stress analysis of involved structures, however, is a subject coming under the purview of other technical societies.

So-called "Rube Goldberg" tests designed to prove quality of a product seem beyond the scope of A.S.T.M. This would also apply to those tests designed to stimulate desire which have as their object the promotion of sales. On the other hand, the Society should seek to show engineers how fatigue data should be used; that is, formulate methods of good practice in measuring the fatigue properties of a structure.

The techniques covering the use of laboratory apparatus as applied to materials testing should be extended to cover parts and simple assemblies. Here the thought was expressed that we should stop short of interpretation of results in the form of particular applications, which is the province of design engineering. Portions of structures, such as floor joists, wall panels, plastered surfaces and jointed pipe, may be tested for performance under simulated service environment. Furthermore, modern process development is tending toward mechanization and this will result in articles of commerce being of composite and prefabricated construction. Specifications and methods of test will be required for such items and these seem within the scope of A.S.T.M. work.

The committee is preparing, for submission to the Executive Committee, a list of specific subjects in this field upon which it believes work should be undertaken.

Respectfully submitted,
J. R. TOWNSEND
Chairman, Special Committee on Testing of Parts and Assemblies

EDITOR'S NOTE: A timely technical paper by R. E. Peterson discussing the Relation Between Life Testing and Conventional Tests of Materials appears in this BULLETIN. It bears directly on the work discussed in this news article.

Mailing of Bulletin

WHILE a "record" of some kind was established in the lateness with which the January BULLETIN was received by members, and it is hoped this unfortunate "record" of delay will not be exceeded, members can expect for some time that the BULLETIN will reach them tardily. This does not mean that the news material included is at all out of date for, on the contrary, news of quite current interest can sometimes be inserted which would not be possible if we were on a normal schedule. The problem of manpower, plus increased printing load on an already crowded schedule, adds several days and in some cases a few weeks to normal delivery dates.

Relation Between Life Testing and Conventional Tests of Materials[1]

By R. E. Peterson[2]

LET US SAY that we have produced a new electric motor, or a new engine, or a new washing machine. We bring it to the test floor, put it through its paces, measure and record everything imaginable, and find that the device behaves satisfactorily. One further question remains—will it repeat this performance, starting and stopping and cycling, year in and year out for a satisfactory life for the equipment? To attempt to settle such a question, life tests are devised to test component parts, usually with the idea of crowding a life of cycling into a reasonably short testing time. As illustrative of this type of test a few examples are given, chosen chiefly from pre-war tests of domestic appliance elements, since these will be well understood without the detailed explanations of functioning which might otherwise be necessary with certain industrial devices.

Consider a simple operation such as opening and closing a refrigerator door. Merely because the door works well for a few times does not mean that it will function satisfactorily over a period of years. The spring in the latch could break due to fatigue, the latch and hinges could wear excessively, the sealing could become inadequate, in fact quite a number of things could happen in this very simple case. In place of a housewife opening and closing the door repeatedly, we make a machine (Fig. 1) which performs the same operation successively, 24 hr. a day. In general, a refrigerator door is not just closed, but is slammed shut, and the machine is made to take this into account. The machine operates at 15 cycles per min. and an equivalent life of 15 yr. is covered in about 12 days.

A similar test for an automatic washing machine door is shown in Fig. 2. This door drops to a horizontal position and the problem is one of repeated impact. In Fig. 3 is shown a crack at each of the hinge attachments as disclosed by this test; as a result the structure was redesigned and satisfactory performance was assured by further tests. Appliances are produced in large quantities when they are produced at all (again we are speaking of nonwar conditions), and it should be obvious to anyone that it makes an enormous difference whether the crack appears during a preliminary 12-day test or later on in thousands of units all over the country.

In Fig. 4 is shown an apparatus to simulate the repeated sliding of a refrigerator tray or drip pan, as a check on durability of finishes, materials, and the design of supports.

Sometimes it is possible to cycle the entire device in such a manner as to answer the main questions in a reasonable time. Figure 5 shows a battery of automatic washing machines which go through successive cycles of filling, washing, draining, rinsing, and spinning, continuously on a 24-hr. basis. The equivalent of 10 yr. life is attained in about $2^1/_2$ months. In this case any corrosive effects are not properly accounted for and precautions must be taken to prevent troubles due to this cause.

In Fig. 6 is shown a device for life testing appliance plugs and terminal pins. The terminal pins are heated and carry current intermittently. After 30,000 operations, the plug must function satisfactorily.

Many more examples could be given in the appliance field, but some mention should be made of the kind of work being done under present war conditions. Figure 7 shows a fatigue test of an airplane generator bracket. The generator is bolted by means of the bracket directly to the rear of an engine with no other support so that the overhung mass causes high stresses in the bracket due to engine vibration. Incidentally, if the bracket would fail completely, the generator would drop off, so that we must be sure that this does not happen during a critical flight, or at any time for that matter. The photograph at the left of Fig. 8 shows a crack produced during a fatigue test run at high stress. At the right of Fig. 8 is shown a Stresscoat pattern in which the first crack was in exact agreement with the location and direction of the fatigue crack. As a result of combined analysis and testing the strength of the bracket now in wide use is approximately six times that of the original experimental bracket.

In Fig. 9 is shown an apparatus for fatigue testing a turbine blade at high temperature. The blade is heated electrically to simulate the temperatures and gradients of

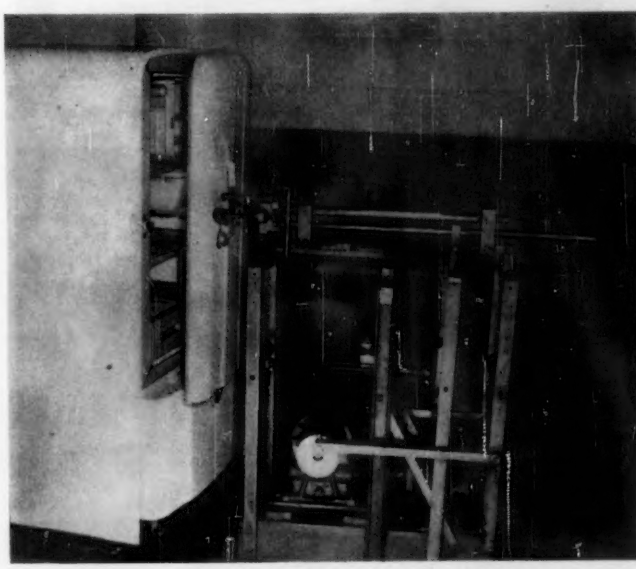


Fig. 1.—Refrigerator Door Slamming Machine.

(An example of a pre-war device for domestic appliance testing.)

NOTE—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia 2, Pa.

[1] Presented at a meeting sponsored by the A.S.T.M. Detroit District Committee, Detroit, Mich., Nov. 21, 1944.

[2] Manager, Mechanics Dept., Research Laboratories, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

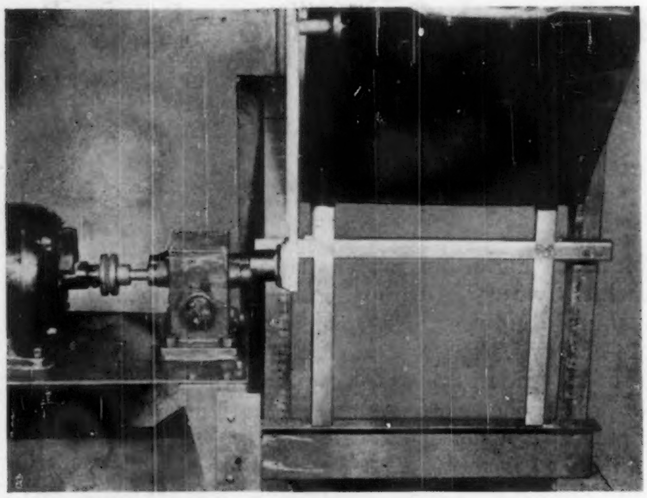


Fig. 2.—Automatic Washing Machine Door Tester.

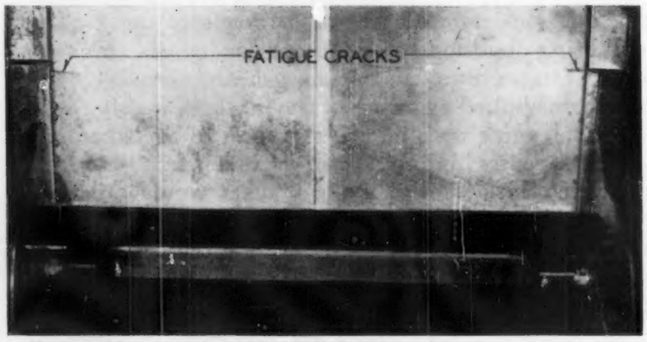


Fig. 3.—Fatigue Crack Developed by Machine Illustrated in Fig. 2.

Fig. 4.—Tray Sliding Apparatus.

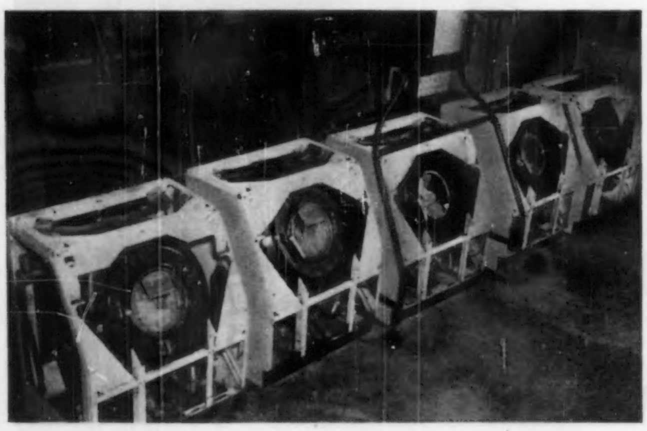


Fig. 5.—Automatic Washing Machines on Repeated Cycling Life Test.

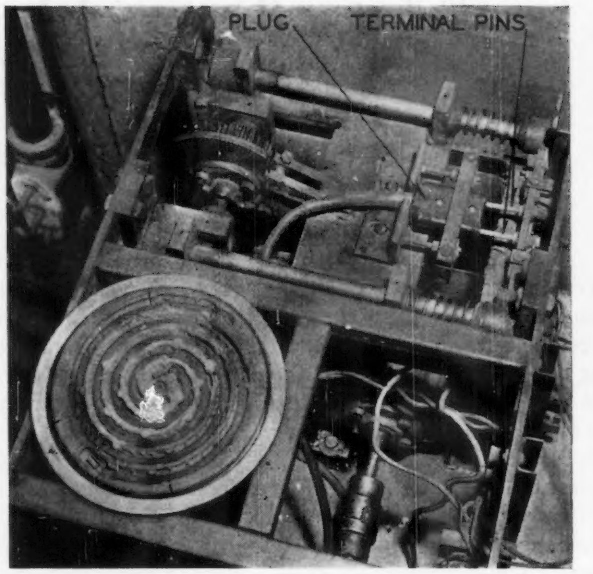


Fig. 6.—Life Testing Device for Appliance Plugs and Terminal Pins.

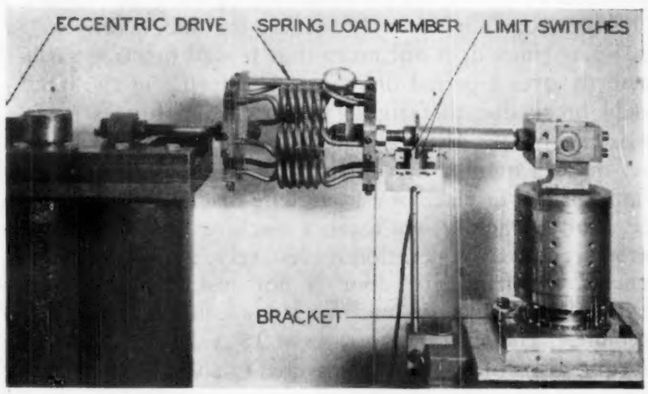
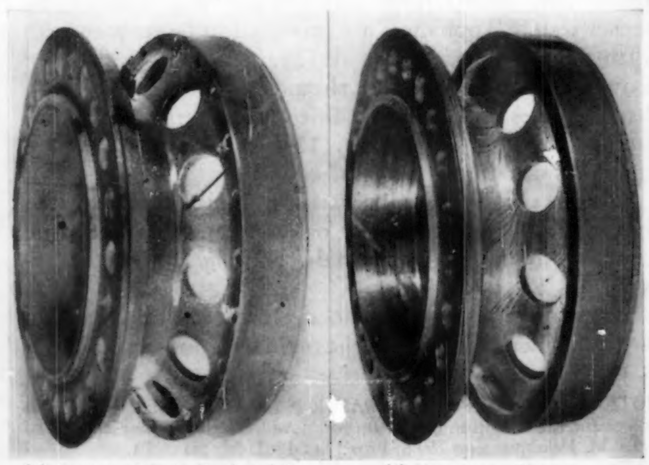


Fig. 7.—Fatigue Testing Apparatus for Airplane Generator Bracket.



(*a*) Fatigue Crack Produced by Machine of Fig. 7.

(*b*) Stresscoat Pattern.

Fig. 8.—Type of Failure Developed in Laboratory.

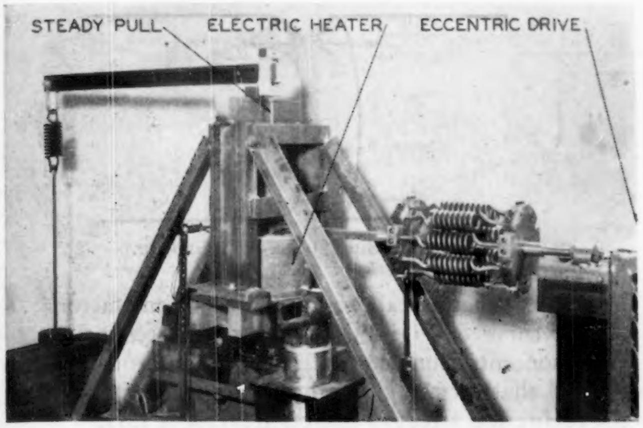


Fig. 9.—Turbine Blade Fatigue Testing Setup.

service. Variable stress is applied by means of an adjustable eccentric. An intermediate spring cage serves as a load measuring device and also permits large motions at the eccentric which reduce wear errors to a negligible amount. Centrifugal force is simulated by a vertical pull mechanism which is flexibly connected. A fatigue crack in a steam turbine blade root as produced in the laboratory apparatus just described is shown in Fig. 10. The apparatus is now being used for testing gas turbine blades. Actual life tests of blading have been made in an experimental turbine, with vibration amplitudes indicated by an ingenious optical method. These methods have led to very important improvements in blade utilization and performance.

In general, life tests should duplicate service conditions as closely as possible. Since it is very easy to overlook an important variable, a great deal of thought should be put into the design of any particular life test and service data should be methodically collected as a guide for future tests.

As has been evident from the foregoing examples, most life tests are rather complicated and usually do not even resemble the tests made in conventional materials testing laboratories. Yet, while we are checking our designs in this way, we are also in the final analysis testing materials, ordinarily under complicated conditions; it is therefore in order to discuss the relationship between life tests and the types of tests which we usually deal with in A.S.T.M.

Fundamentals of Life Testing

Since our devices pass test floor runs before life testing, we can omit from the present discussion all of the so-called "short-time" properties, such as tensile strength, yield strength, single-blow impact value, etc. In analyzing life testing in terms of its fundamental elements, we notice that *time* and *cycling* are the important characteristics. This leads us to consideration of the following conventional tests:

Group A
1. Fatigue.
2. Creep (including relaxation and creep-rupture).

Group B
3. Wear (including erosion and fretting).
4. Corrosion, deterioration of nonmetallic materials and lubricants.
5. Repeated impact.

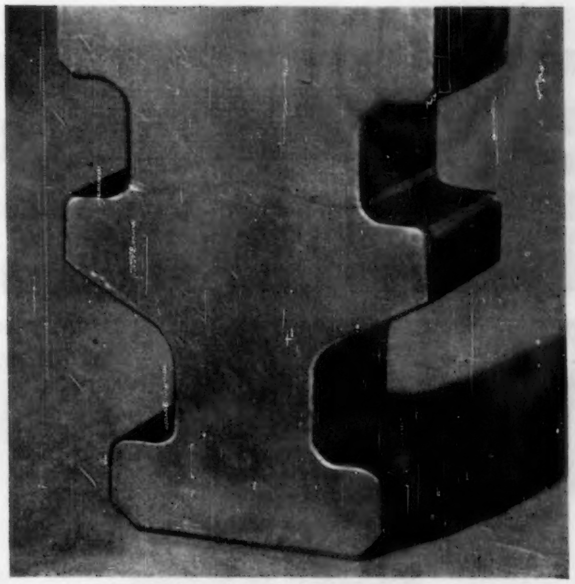


Fig. 10.—Crack Produced by Laboratory Apparatus of Fig. 9.

Note that these tests may be divided into two groups: group A—quantitative tests, capable of giving specific design data; group B—qualitative tests, useful primarily for a comparison of materials.

If the main problem of our hypothetical new machine is in the second group, say a wear problem, we cannot solve the problem by looking up data and calculating the answer; nor can we get the desired design data by making a conventional test. A life test simulating actual conditions as closely as possible is very much in order for problems of this kind.

If the problem is in the first category, that is, fatigue or creep, there is at least a possibility of predicting satisfactory performance. But even if we are dealing with a relatively simple problem, there are more considerations involved than is generally appreciated. Let us examine such a problem in detail.

Fatigue Problem

Suppose that the critical section of our device is the fillet section of an axle in bending as shown in Fig. 11. Let us say that the material used is normalized S.A.E. 1035 steel with a nominal endurance limit of 34,000 psi.

As is well known a fillet causes a local increase of stress (Fig. 12), as evidenced by the crowding of the photoelastic fringelines in the fillet as compared to their even spacing in the straight part of the bent bar where the stress distribution is linear. This local increase of stress is expressed technically in terms of a stress concentration fac-

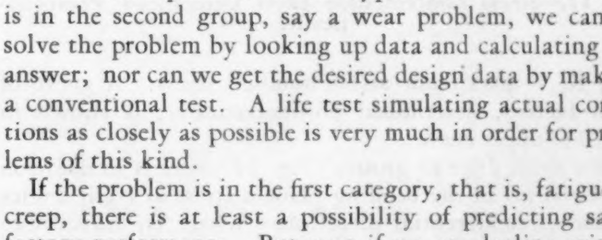


Fig. 11.—Example Used for Fatigue Problem.

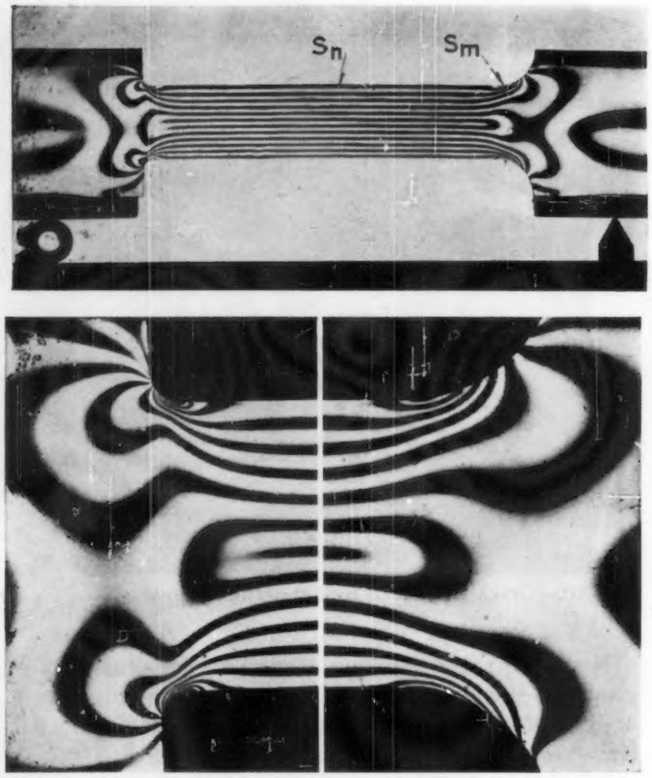


Fig. 12.—Stress Concentration Effect Determined Photoelastically.

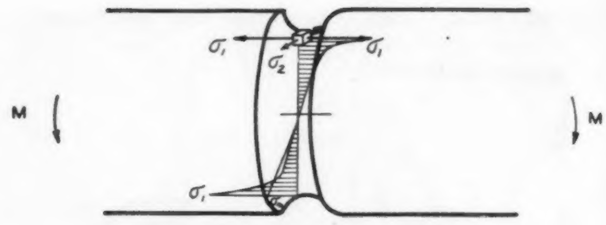


Fig. 14.—Biaxial Stress in Groove.

tor, K_t = maximum stress/nominal stress. A curve of such factors, determined photoelastically, is shown in Fig. 13 (upper curve).

In a shaft fillet or groove (Fig. 14) there is in addition to the stress in the bending plane a stress at right angles in the circumferential direction. Where we have more than one stress we need a strength theory. We have found that for ductile materials, the shear energy theory fits available fatigue data reasonably well. Since the two stresses mentioned above are related by a constant we can figure a "theoretical strength reduction factor", K_t' (lower curve of Fig. 13), which takes account of both stress concentration and strength theory. From this curve we find that for the given shaft dimensions ($r/d = {}^1/_{32}$), the theoretical strength reduction factor is 1.85.

We are not yet ready to finish this problem, which as mentioned before is a relatively simple one. We still must consider the material, for we know that high-strength heat-treated steels are highly sensitive to notch effects, while normalized steels are less sensitive. This is usually expressed by a "sensitivity index," q, defined as follows:

$$q = \frac{K_f - 1}{K_t' - 1}$$

where

$$K_f = \frac{S_e}{S_n} = \frac{\text{endurance limit without fillet}}{\text{nominal endurance limit with fillet}}$$

(S_e is obtained from tests of conventional fatigue specimens preferably $^1/_2$ in. diameter or larger)

K_t' = theoretical strength reduction factor.

As can be seen from Fig. 15, q is defined in such a way that for no notch effect in fatigue (that is, $K_f = 1$) $q = 0$, and for full theoretical notch effect (that is, $K_f = K_t'$) $q = 1$. This gives a scale from 0 to 1 for evaluating notch sensitivity; the K_f point shown on Fig. 15 corresponds to $q = {}^1/_2$.

It is unfortunate that we do not have a better term than

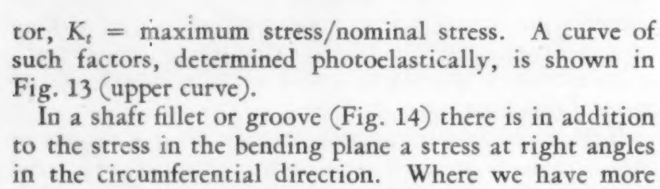


Fig. 13.—Fillet Factors.

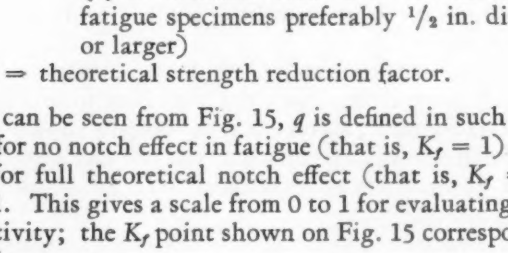


Fig. 15.—Definition of Notch Sensitivity.

$$q = \frac{K_f - 1}{K'_t - 1}$$

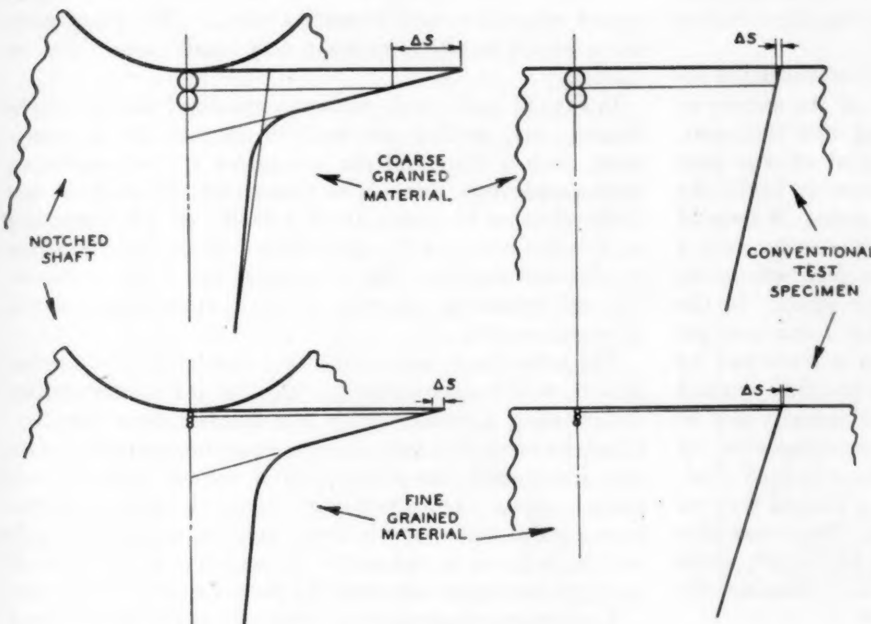


Fig. 16.—Stress Gradient Effect.

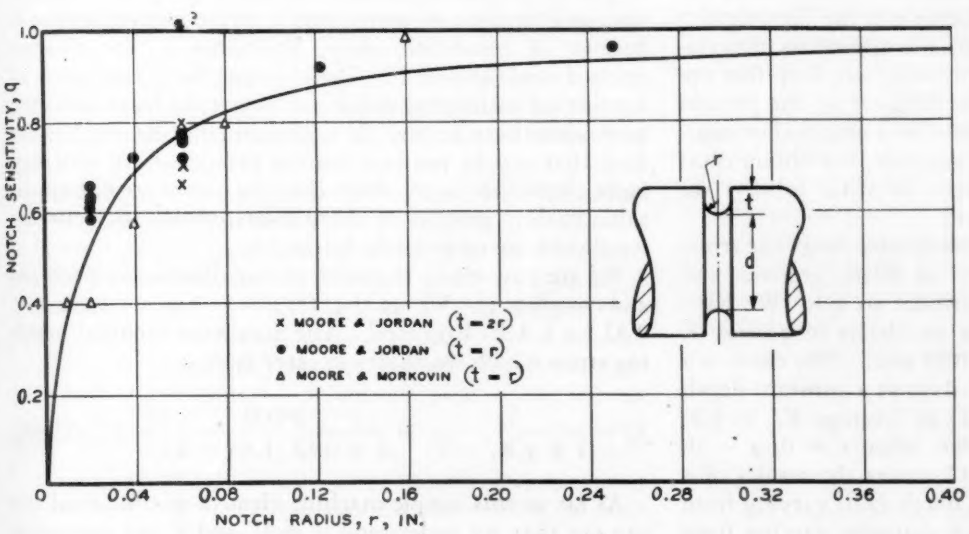


Fig. 17.—Notch Sensitivity—S.A.E. 1020 Steel.

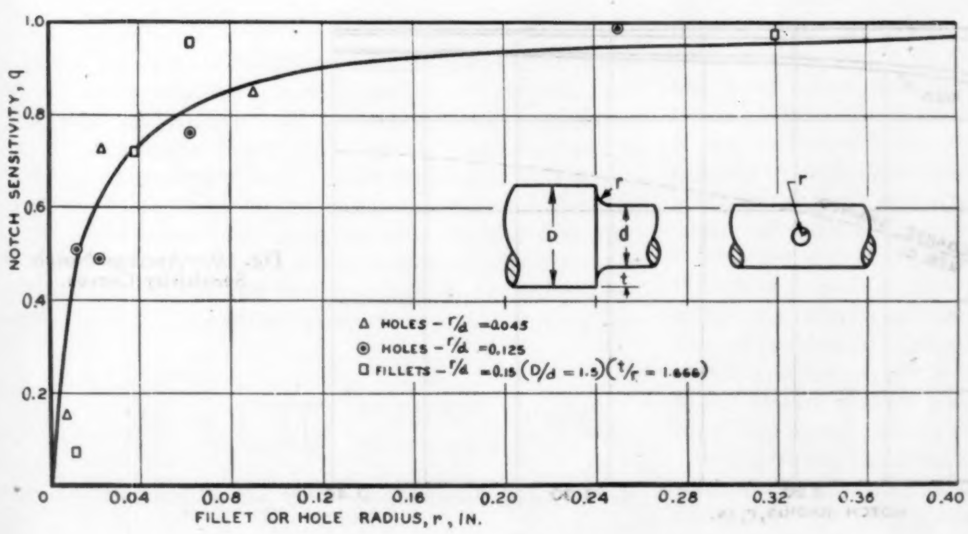


Fig. 18.—Notch Sensitivity—Nickel Molybdenum Steel.

"sensitivity" since it connotes a mysterious characteristic possessed by materials. Suppose we examine the variables involved.

A fillet, notch, or other form of stress concentration introduces a steep stress gradient (Fig. 16) at the surface as compared with a conventional bending test specimen. Suppose we have a coarse-grained material so that near the fillet surface where the stress gradient is high, the stress drops, say, 25 per cent in crossing a grain. We would not expect to obtain the same fatigue behavior for such a case as we would with a conventional test piece where the drop in stress across a grain is relatively small. In the former case it should be more difficult for a crack to get started and to propagate itself; and this is confirmed by testing experience. A notched specimen of coarse-grained annealed or normalized carbon steel will usually not be reduced in fatigue strength as much, percentagewise, as will a similar specimen of fine-grained heat-treated steel. These results, then, seem explainable in a general way on the basis of grain size and stress gradient. There may also be present a cold working effect, but in any event, stress gradient is a logical parameter to use in evaluating the effect of various notches or "stress raisers."

A scientific approach in application of stress gradient suggests use of a dimensionless variable, gradient multiplied by grain size divided by endurance limit. This has possibilities as was shown in an article in the Timoshenko Anniversary Volume (Macmillan), but difficulties of evaluating grain size or a similar structural unit keep this approach from being useful to the designer at the present time. Another way, which is more of a practical or engineering approach, is to still use gradient, but obtain typical curves for different materials. In what follows we shall deal with this latter method.

It can be shown that over a considerable range the stress gradients of such "stress raisers" as fillets, grooves, and holes are approximately proportional to $1/r$. We have therefore plotted available data on charts of q *versus* r; Fig. 17 is such a chart for S.A.E. 1020 steel. The curve is a theoretical one based on: (1) failure at a constant depth (0.002 in. for S.A.E. 1020); (2) an average $K_t' = 1.8$; (3) curve shifted laterally so that when $r = 0$, $q = 0$. Considering the fact that Fig. 17 covers the results of a wide variety of test pieces with notch radii varying from 0.02 in. to 0.25 in. and specimen diameter varying from 0.16 in. to 2 in., it appears that the results can be represented reasonably well by such a curve. (The point with the question mark represents a very small piece $^1/_8$ in. in diameter.)

In Fig. 18 data are shown for normalized nickel molybdenum steel; in this case some of the data are for specimens with a fillet and the remainder are for specimens with a transverse hole. Note that a very tiny hole has but little effect on the strength of a shaft; in other words q approaches zero and K_f approaches 1 as the hole becomes smaller and smaller. The theoretical factor K_t, of course, does not behave in this way, in fact it approaches 3 as r/d approaches zero.

The same thing can be said for a semicircular or similar groove, which approaches zero effect as it becomes smaller and smaller, a result which is borne out by experience. Every so often it seems that we encounter someone who has determined the contour of a minute scratch, has picked out a "corresponding" large theoretical factor from a publication, and believes that the fatigue strength will be reduced accordingly. In such a case the fault is not with the theory but with the person who misapplies it.

A summary of notch sensitivity curves of the type just described is given in Fig. 19. The top curve represents fine-grained quenched and tempered steels, the middle pair of curves represent normalized steels of medium grain size, and the bottom curve (which carries a question mark because of insufficient data) represents a very coarse-grained steel (as rolled). These curves, then, may serve as a guide for estimating notch sensitivity, at least until we have something better. It is obvious that we need more data that can be put into similar form, but we will say more about that later. Note that the curves are not applicable to deep grooves or sharp fillets, which incidentally we should try to avoid in design.

We are now ready to return to our illustrative problem and complete it. We see that for $r = {}^1/_{16}$ in. we have $q = 0.82$ for S.A.E. 1035 steel. The maximum nominal bending stress which the shaft can carry is then

$$S_n = \frac{S_e}{1 + q(K_t' - 1)} = \frac{34000}{1 + 0.82\,(1.85 - 1)} = 20{,}000 \text{ psi.}$$

As far as this simple machine element is concerned we can say that we understand it well, and if our operating

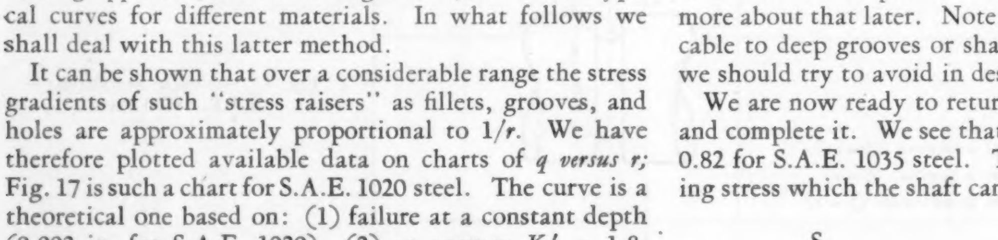


Fig. 19.—Average Notch Sensitivity Curves.

stresses are substantially lower it should not be necessary to make life tests. Unfortunately, our knowledge is so limited that we cannot often make such a confident prediction. But progress is being made and we are getting reasonable checks on increasingly difficult problems, such as turbine blade fastenings, gear units, etc.

If in the foregoing problem we were using a heat-treated alloy steel, say S.A.E. X4130, we would have $q = 0.95$ as compared to 0.82 for S.A.E. 1035. The q values for these two materials are not as far apart in this case as they might be in some other example such as, for instance, a threaded shaft. It is possible for an inherently weaker material to come out as well as an inherently stronger material as a result of notch sensitivity.

To summarize the situation as far as fatigue is concerned, if we are concerned with the critical section of a machine part, we are dealing, not with the ideal contour of a conventional test specimen, but almost invariably with some form of stress concentration. In a simple case this involves three items: S_e, K_t' and q. If we do not make use of q (that is, let $q = 1$), our estimate will be more or less in error, but it should be noted that whatever error is made will be on the safe side. As mentioned elsewhere, for quenched-and-tempered materials, from which most highly stressed machined parts are made, we may take $q = 1$ with sufficient accuracy for nearly all cases of practical interest.

The question of "standardizing" a notched specimen for evaluating sensitivity comes up frequently. In Fig. 20 are shown the main dimensions of a specimen used in Germany for evaluation of notch effect, and in Fig. 21 is reproduced a table of sensitivity values. (η_K is the same as our q). If we were limited to a single test specimen, it is interesting to note from Fig. 19 that the notch radius of the German test specimen is such as to show up large differences in materials. However, it is definitely misleading to list sensitivity values as properties of materials, as in Fig. 21, since the values may then be erroneously interpreted as constants which are characteristic of various materials. We see from Fig. 19 that if we go to large radii these factors approach unity. The use of values such as given in Fig. 21 would be particularly unfortunate if applied to the design of large members since the error would then be on the unsafe side.

Creep of Metals

So far we have elaborated on only one of the two quantitative tests mentioned, namely, fatigue. Creep data are of interest in steels primarily at elevated temperatures, but for die castings and other soft metals important effects occur at room temperature. Space will not permit an extensive discussion of the many aspects of the subjects of creep, relaxation, and creep-rupture. In the first two cases, integrated effects of the behavior of large masses of grains are involved and therefore analytical methods are appropriate as a means of interpreting and extending test

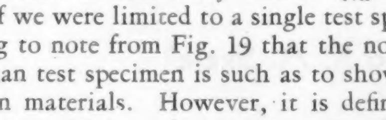


Fig. 20.—Notched Fatigue Specimen (Materialprüfungsanstalt-Darmstadt).

Eigenschaften der untersuchten Stähle
(Festigkeiten in kg/mm²)

Bezeichnung	Analyse %	Zug-festigkeit σ_B	Streck-grenze σ_S	Biege-wechsel-festigkeit σ_W'	Verdreh-wechsel-festigkeit τ_W'	Empfind-lichkeits-ziffer η_k
1. St 37	0,1 C	43	38	23	—	0,5
2. St 37	0,16 C	44	32	22	—	0,63
3. Si-Baustahl St 52	0,15 C. 1,0 Si; 0,9 Mn	59	43	38	21	0,85
4. C-Stahl	0,78 C	62	35	30	—	0,57
5. C-Stahl	1,2 C	61	—	26	—	0,42
6. St 60	0,3 C 0,9 Mn	65	42	32	—	0,49
7. St 80	0,48 C 1,3 Mn	81	50	36	—	0,48
8. VCN 35 gegl.	0,23 C 0,7 Cr; 3,7 Ni	67	46	42	—	0,61
9. Cr-Ni-Mn-Stahl verg.	0,36 C 1,25 Mn 0,6 Cr; 3,5 Ni	116	109	59	30	0,92
10. Cr-Stahl (austenitisch)	19,5 Cr; 6,0 Ni	65	24	25	—	0.0
11. Cr-Stahl (martensitisch)	13 Cr; 1,8 Ni	82	78	40	—	0,53

Fig. 21.—Properties of Steels (*Forschung*, Vol. 5, p. 40 (1934)).

data. In fact, if we are trying to predict how much a red-hot part inside of a turbine will creep in 10 or 20 yr. we must extrapolate by mathematical means from the results of creep tests of a few months' duration. It is not a question of whether or not to extrapolate—it is only a question of whether we do it poorly or well, whether we guess or whether we use the best available data and analytical methods.

In the case of creep rupture (that is, brittle failure after an extended time at constant load and temperature), the experimental approach will be the main one for some time. We think of creep-rupture mainly at elevated temperatures, but it can occur, for example, in soldered joints at room temperature.

Discussion

It will be noticed that in general we are emphasizing a more basic and detailed approach in design applications of materials. It may be remarked that since a factor of safety is always used anyway, refinement in design is a waste of time. Such a viewpoint would not be in keeping with modern trends in design. The aviation industry, and many others, find that it pays to make extensive detailed analyses coupled with numerous tests of all kinds. A new and rapidly growing technical society is devoted entirely to experimental stress analysis. In these days, it seems particularly characteristic of designers that they are continually asking for more information of a basic nature.

This is not to say that life testing will become obsolete. For certain problems involving wear, friction, lubrication, etc., there is no other way. For many complicated fatigue problems a life test is most certainly advisable, but it is hoped that as our knowledge increases we will make better designs quicker and will use life testing as a check on design rather than as a cut-and-try procedure.

It might also be added that even now life testing is applied chiefly to items of large production. It is not possible to life test large generator or turbine rotors, or many

items produced in quantities of one or a small number. We must rely in these cases entirely on the designer and the more information he has the better.

Suggestions for Further Work

In concluding, it is in order to suggest the kind of information which we should be getting to be of most value along the lines indicated. As will be noted the fields of interest of several technical societies are involved.

In the fatigue testing field we need more data of the kind shown in Fig. 19 for a variety of materials, and also for fillets and deep grooves. Included among the materials should be stainless steel for which Fig. 21 shows $q = 0$. We also need data on threaded members and on shafts with keyways. We have referred mainly to bending and there are, of course, corresponding problems in torsion. From a research angle more direct-stress tests (Haigh type) should be made, since in this test we have zero gradient for unnotched specimens. Then there are combined stress problems. More suggestions could be made, but it should be realized that those just made cover an enormous amount of fatigue testing. However, it is work well worth doing. Someone has said that over 90 per cent of all service failures are due to fatigue, but whether such a percentage is correct or not, fatigue failures are often serious in that in many cases the apparatus ceases to function and, furthermore, due to the lack of warning sometimes serious accidents result.

In the field of photoelasticity it would be helpful to have more information on stress gradients, for which purpose the photoelastic techniques are uniquely suited. In this respect photoelasticity has no competition, whereas with many other problems of experimental stress analysis it is often better to make use of modern strain gage techniques.

In the field of creep testing, more test data from conventional tests are needed plus mathematical analysis to treat cases of relaxation and nonuniform stress distribution. In creep-rupture testing, notch effects will be of importance and should form a basis of further work.

In the field of mechanical engineering design, we need further analyses of combined stress cases together with application of strength theories.

In conclusion, it can be said that life testing, field tests, laboratory tests of conventional specimens, stress analysis, and studies of mechanics of materials all have a proper place in the over-all picture, and if we wish to make the most effective progress in basic design practice we should plan our work so that the results obtained in these fields can be correlated in a fundamental manner.

A Variable Cycle Alternate Immersion Corrosion Testing Machine

By C. H. Mahoney, A. L. Tarr, and K. A. Skeie[1]

The recent efforts of the Society to standardize procedures for making alternate immersion tests on non-ferrous metals and alloys focus attention to equipment for making tests in accordance with the newly proposed procedures. We are all generally acquainted with various ingenious devices for such testing which usually incorporate the use of a rotating shaft to which the specimens are attached by means of strings, either directly or through the medium of a rack.

In the early stages of organizing our laboratory we reviewed the available information on alternate immersion testing methods and equipment. It was concluded that for our requirements we should design a machine which was capable of variable but accurately controlled immersion and drying cycles, in which the atmosphere to which the specimens were exposed during drying could be circulated under predetermined temperature and humidity conditions, and which was capable of testing approximately 50 samples simultaneously. Later tests with the designed equipment indicated that circulation of the atmosphere was not necessary for most testing requirements.

The machine described in this paper, Fig. 1,[2] was designed before the new A.S.T.M. Tentative Method of Alternate Immersion Corrosion Test of Non-Ferrous Metals (B 192–44 T)[3] was submitted for approval. It seems, however, that all requirements for both the "wet-dry modification" test and the "continuous wet modification" test are met in this equipment, and the results obtained with it in our laboratory have been so satisfactory that we are offering it to the industry in the hope that some general benefit may be realized.

Briefly, this variable cycle machine tests up to 48 specimens or clusters of specimens in separate glass solution containers which are heated by a common thermostatically controlled bath. The specimens, suspended from the rack by means of glass stirrups (see *B*, Fig. 1) are raised and lowered alternately by a sprocket chain attached to a motor-driven cam. The immersion and aeration periods are automatically controlled by means of independent time switches which permit variations in the periods ranging from a few seconds to 1/2 hr.

After the machine was constructed and put through trial runs, some shortcomings were observed and it was

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia 2, Pa.

[1] Chief Metallurgist, Supervisor of Metallurgical Laboratory, and Metallurgist, respectively, of Basic Magnesium, Inc.

[2] A general assembly drawing, K-182 showing the constructional features of the machine; details drawings K-199 and K-200; electric wiring required, drawing K-202; and a list of essential constructional materials and other items can be secured from A.S.T.M. headquarters by those requesting them.

[3] 1944 Book of A.S.T.M. Standards, Part I, p. 1860.

found necessary to make the following minor changes. Two 40-watt lamps with safety globes were installed inside the hood near the rear corners to improve visibility. Also, an extension shaft with flange and brake drum was bolted to the motor drive pulley and a magnetic brake (General Electric Cat. No. 5368903G4—Type CR9516-462) was installed underneath the machine in order to prevent any over-carry of the driving mechanism. This solenoid brake is of a far greater capacity than is required for successful operation, but it is essential that some means of preventing excessive over-travel be used. It would probably be desirable to install some type of stirrer for the heating bath, but for temperatures not far above room temperature natural convection has given uniform temperature throughout the bath. The machine was equipped with a blower as shown in Fig. 1, *A*, but it has not been necessary to use it for the drying during the aeration phase of the cycle of normal specimens having fairly smooth contours. The blower motor is operated independently by a toggle switch and has been used only to accelerate final drying of the specimens before their removal for examination. To cushion the beakers against shock, the beaker rack was covered with a sheet of Tygon with holes cut to accommodate the test beakers. We encountered no difficulty in maintaining a relative humidity of between 50 and 70 per cent in the test chamber; however, a more accurate control may be found expedient for special test conditions.

A special feature of the machine is the wide range of cycles which can be obtained by means of the time relays used to control the immersion and draining phases. Each relay has a coarse adjustment made by placing a pawl in one of four notches, located under the right-hand corner of a calibrating plate, and a fine adjustment made by rotating a pointer on the calibrating plate. For satisfactory operation the relay should not be set for a shorter time interval than $^1/_2$ sec.[4]

POSSIBLE RANGE OF ALTERNATE CYCLES ON 60-CYCLE CURRENT.

Location of Pawl	Minimum	Maximum
Inner notch...........	$^1/_2$ sec.	29 sec.
Second notch..........	$^1/_2$ sec.	2 min. 14 sec.
Third notch...........	$^1/_2$ sec.	8 min. 48 sec.
Outer notch...........	$^1/_2$ sec.	33 min. 30 sec.

Another feature of the machine is the provision of separate beakers for each specimen or cluster of specimens. This offers a wide scope of test possibilities. Duplicate samples may be simultaneously tested in a number of corrosion media, samples of a number of different alloys or materials may be tested without fear of cross contamination by the products of corrosion from adjoining or other specimens, and the unit is admirably suited for control testing to determine if successive lots of the same material have similar corrosion resistance properties. The Berzelius type, 1000-ml. capacity beakers used in this machine are equally suited to both disk, specimens and physical test bars. Their dimensions are approximately $3^1/_2$ in. in diameter by 7 in. deep. The volume of corroding solution to specimen area provides a reasonably high ratio for most test specimens.

The design of the specimen rack prevents pendulum action of specimens without introducing undue rigidity which might cause the glass stirrups to break on sudden starts and stops of the specimen rack. The rack pulls forward from the testing cabinet to allow for rapid examination and handling of the specimens.

The roof of the hood is of substantial construction, making it possible to place heavy bottles of water or similar objects on its top. The beaker rack, at the base of the hood, is at a height which is suitable for easy manipulation of specimens and beakers.

No doubt this machine can be improved in several respects but the results in our laboratory indicate its superiority to the others which we have seen in use. It is hoped that it will answer all requirements set forth in Method B 192 prepared by the Society in its attempts to standardize alternate-immersion corrosion testing.

[4] The SG type relays (Westinghouse Style 1008539) used for energizing these time relays should be replaced by a more substantial type of relay if continuous operation is anticipated.

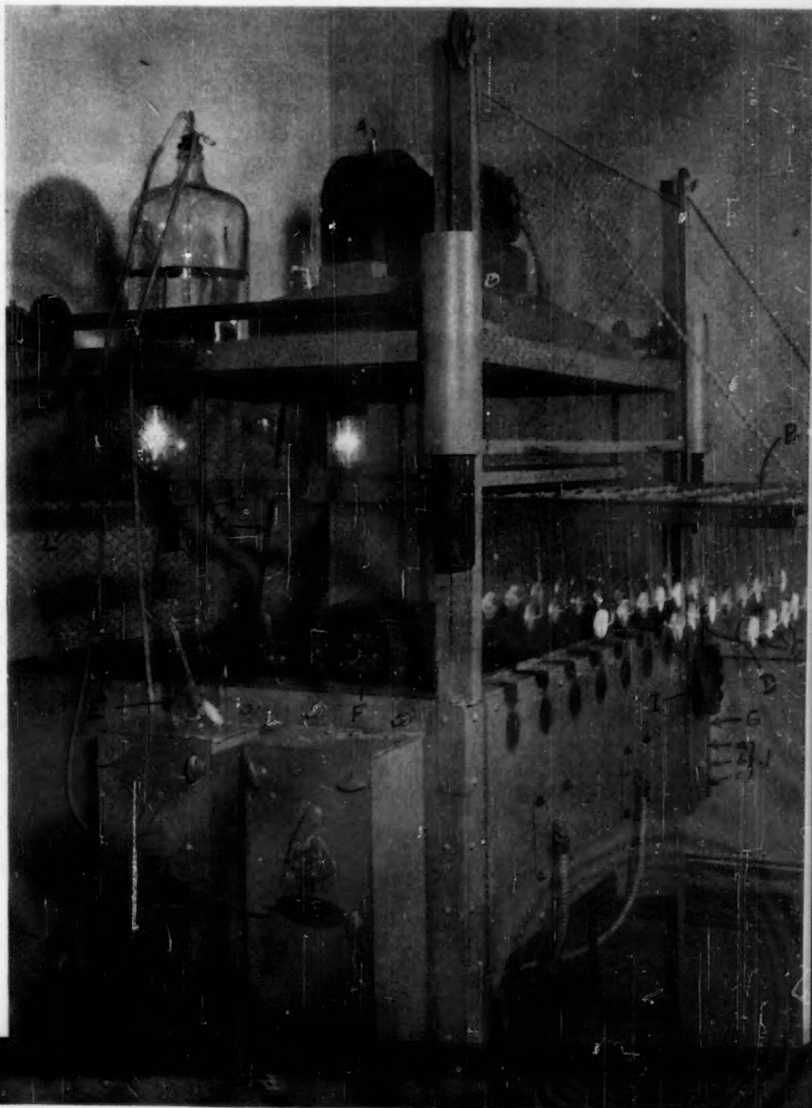


Fig. 1.—Specimen Rack in Position for Examination of Specimen.

A = blower.
B = specimen rack.
C = disk specimens.
D = glass stirrups.
E = Berzelius beaker, 1000-ml. capacity.
F = beakers set in water bath.
G = control box housing relays.
H = breaker boxes for drive-motor and heaters.
I = starting switch.
J = toggle switches for:
 a—heaters,
 b—blower,
 c—lights.
K = sprocket chain attached to motor-driven cam.
L = specimen rack carrier raised and lowered by 4 sprocket chains connected by pulley arrangement to drive sprocket.

A Rubber Housing for Waterproofing the Bonded-Wire Strain Gage

By Douglas McHenry[1]

THE bonded-wire electric strain gage, known as the SR-4 gage, has opened up new and extremely far-reaching possibilities in the field of experimental stress analysis. The gage has been described so frequently in recent technical literature[2] that no description need be given here, other than to say that it consists of a little slip of paper to which a very fine wire is bonded by a celluloid or resin cement, and that this slip of paper is simply cemented to the material to be tested. Strains in the material, transmitted through the paper to the fine wire, are determined with an accuracy of 1 or 2 per cent by measuring changes in the electrical resistance of the wire as it elongates or contracts. An idea of the importance and popularity of this gage is conveyed by the fact that over 300,000 were put in service in 1944.

The required accuracy of the electrical resistance measurement is of such an order that the surface of the gage must be completely dry during use. The engineer whose tests require strain measurements out of doors, under water, or in the interior of concrete has therefore made only limited use of this new and very useful testing method.

The problem of waterproofing the gages arose in the testing laboratories of the Bureau of Reclamation in connection with strain measurements on reinforcing bars embedded in concrete. Numerous asphaltic, plastic, and similar waterproofing compounds were investigated, and some degree of success was attained by simply applying a heavy coating of the compound over the gage and the bare portion of the lead wires. This scheme afforded less positive protection than was desired, however, and in addition it presented the disturbing possibility that the accuracy of the gage might be influenced by the direct contact with the covering material. A rubber housing, or button, was therefore devised which appears to be free from the disadvantages of the asphaltic or plastic coating.

A $^3/_4$-in. square steel bar test specimen with the strain gage and rubber button attached is shown in Fig. 1; and Fig. 2 shows an enlarged cutaway view of the gage and button. These buttons are made of "neoprene" using the mold and mandrel shown by Fig. 3. It will be noted that the mandrel forms a hole for the lead wire, and also forms a cavity which prevents direct contact of the rubber with the SR-4 gage.

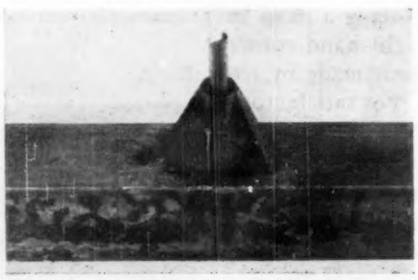


Fig. 1.—Strain Gage and Rubber Button Attached to $^3/_4$-in. Square Steel Test Specimen.

The procedure of attaching the gage and button to the test member is, briefly, as follows. One of the two short lead wires of the gage is grounded to the bar by inserting it into a $^1/_{32}$-in. drill hole, where it is secured by a bit of solder or a small wedge. The paper gage is then cemented down and allowed to dry for a few minutes. A piece of felt trimmed to fit the gage is next cemented over the paper (some gages have the felt already attached) and the other short lead wire is doubled back across the felt and secured in this position by cementing over it a second layer of felt. The insulated terminal lead wire and the button are then assembled

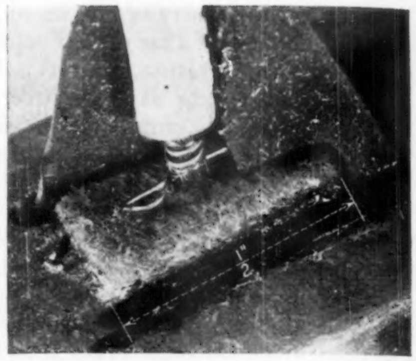


Fig. 2.—Detail of the Felt-Covered Paper Strain Gage and Cutaway View of the Rubber Button.

by wrapping a thin layer of semicured "neoprene" around the insulation of the wire and inserting it into the hole in the button, bending back the stripped end of the wire (about $^1/_8$ in. long) so that it lies flat against the top of the cavity. The lead wire of the gage is then soldered to this bare portion, and the extra length is doubled back on itself in the cavity so that the button fits properly over the gage.

The method of attaching the button to the steel will depend upon the particular requirements of the test. For use on reinforcing steel, where the rubber-metal joint must withstand the rough treatment involved in concrete placing operations, vulcanizing is the best method which has been developed so far. A remarkably strong joint may be made by applying vulcanizing ce-

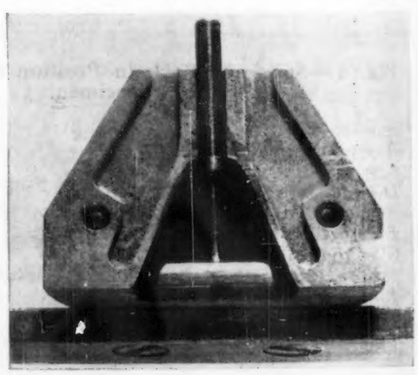


Fig. 3.—Mold for Vulcanizing the Rubber Buttons.

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[2] Charles Lipson, "Methods of Stress Determination in Engine Parts," *Journal*, Soc. Automotive Engrs., Vol. 51, pp. 105–124 (1943); C. O. Dohrenwend and W. R. Mehaffey, "Measurement of Dynamic Strain," *Journal Applied Mechanics*, Am. Soc. Mechanical Engrs., Vol. 10, pp. A85–A92 (1943); D. M. Nielsen, "Strain Gages," *Electronics*, Vol. 16, pp. 106–111 (1943).

ment to the steel, overlaying this with a thin layer of semicured "neoprene," and vulcanizing the joint under pressure. The pressure may be applied by means of the mold (Fig. 3) in which the buttons are made. If the strength and waterproofing requirements are less rigid, the button may be simply cemented to the steel or other material without using heat or pressure; and in that case the seal where the lead wire passes through the button will also be effected by cement.

It will be advantageous for the user to work out the full details of the procedure by experimentation; for there is no assurance that the materials and techniques which are suited to a particular application will be suitable for all others.

This protective scheme has been used successfully in several pull-out specimens and in laboratory beams tested to failure under various loading conditions.

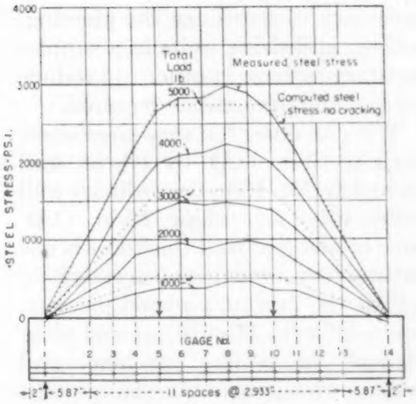

Fig. 4.—Distribution of Steel Stress Prior to Cracking in 8 by 8 by 48-in. Concrete Beam Reinforced by One 3/4-in. Square Bar.

The single example shown by Fig. 4 will illustrate the possibilities of this gaging method in extending our somewhat meager knowledge of stresses in reinforced concrete members and structures. Fourteen strain gages of 1/2-in. gage length were attached to a reinforcing bar which was embedded in a 8 by 8 by 48-in. beam. As shown by the chart, the measured and computed steel stresses in this beam were in good agreement before cracking developed in the concrete. A continuation of the test to failure showed that this agreement was much less satisfactory after cracking started; but more experimental work is required before the nature of the disagreement can be satisfactorily interpreted or generalized.

The Manufacture of Heavy-Wall Pipe 12 3/4 to 24 In. Outside Diameter

By E. C. Wright[1]

EDITOR'S NOTE: This paper should be of interest to a number of consumers who have had difficulty and delay in obtaining pipe in the sizes and weights referred to, and it is timely also because of the detailed considerations being given in Committee A-1 on Steel pertaining to requirements for alloy steel pipe which will not be subject to graphitization at elevated temperatures. At the moment, revisions are being suggested in the Specifications for Carbon-Molybdenum Steel Pipe for Temperatures from 750 to 1000 F. (A. 206) with new specifications proposed to cover chromium-molybdenum pipe for service at elevated temperatures. In order that pipe manufacturers might fill orders as expeditiously as possible and maintain stocks, the users and producers agreed on certain sizes listed in the Appendix to Specifications A 206.

THE rolling of special heavy-wall pipe in large diameters, particularly between 12¾ in. and 20-in. outside diameter, with wall thicknesses exceeding 1 in., has always been an extremely difficult problem. This is due mainly to the fact that this pipe has always been ordered in very small quantities and the seamless tube mills on which this work must be done were originally designed and laid out to make pipe of common wall thicknesses.

Most of this pipe has been used for high-pressure steam mains connecting the high-pressure boiler with the turbine where service conditions range from 800 to 2000 psi. pressure and up to 1000 F. Occasional uses for such pipe are also found in high-pressure chemical plant and oil refinery equipment, and for special hydraulic piping used at room temperature. Pipe for high-temperature use has been purchased to A.S.T.M. Tentative Specifications for Seamless Carbon-Molybdenum Alloy-Steel Pipe for Service at Temperatures from 750 to 1000 F. (A 206-44 T).[2] Table I shows typical sizes which have been most commonly used.

A glance at the figures in Table I will show that round billets of very large diameter and heavy weight are necessary to produce these pipe sizes. Seamless pipe mills require

TABLE I.

Outside Diameter, in.	Wall Thickness, in.	Schedule No.	Weight, lb. per ft.	Nominal Length to Cut, ft.	Rolled Length Before Cutting, ft.	Weight of Rolled Pipe, lb.
10¾	1.125	160	116	25	31	3596
10¾	0.843	120	89	30	36	3204
12¾	1.312	160	160	25	31	4960
12¾	1.000	120	125	30	36	4500
14	1.406	160	189	25	31	5860
14	1.062	120	147	30	36	5192
16	1.562	160	241	20	26	6266
16	1.218	120	192	25	31	5952

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[2] 1944 Book of A.S.T.M. Standards, Part I, p. 1321.

round billets for piercing, and very few steel mills in the United States can roll rounds over 7 in. in diameter. As a result, the procurement of the round sizes required is limited to a very few sources and such material can be obtained only under special conditions. If small quantities are required, as represented by such orders as 80 to 200 ft. of pipe, the purchase of the rounds becomes even more troublesome. Long delays are almost always encountered in securing proper billets since usually a whole heat of steel must be made which exceeds 100 tons in the open hearth, and at least 25 tons in the present-day electric furnace. The purchaser of rounds is usually asked by the steel melter to take the product of a whole heat as the steel producer generally has no outlet for the excess steel. About the only manner in which such rounds, if made from electric furnace steel, can now be obtained, is by forging of ingots, and since forged rounds from ingots are quite rough and inaccurate in diameter it is usually desirable to turn or peel such rounds to remove surface defects and get accurate dimensions.

The steel melter is also troubled with the problem of selecting the proper ingot size and weight to cut such billets as 12-in. outside diameter, 5000 lb. or $10\frac{1}{2}$-in. O.D., 3500 lb. Often the ingot mold size and weight of ingot is such that only 50 to 60 per cent of the ingot can be cut to the proper weight of the billet. This is particularly true of alloy steel melting shops with electric furnaces where ingot weights rarely exceed 15,000 lb. and where 8000 to 10,000-lb. ingots are usually standard equipment. It will be evident that it is possible to cut only one round billet weighing between 4000 and 6000 lb. from an ingot weighing 8000 to 10,000 lb. since the normal crop loss from hot topping and bottom crop frequently exceeds 25 per cent.

The seamless tube manufacturing unit consists of the following five vital components:

1. Heating furnaces.
2. Piercing mills.
3. Two-Hi rolling mill.
4. Reelers.
5. Sizing mills.

In making any given pipe size it is necessary to rearrange the piercing, rolling, and sizing units in a supplementary fashion in order to produce pipe of the dimensions required.

With an order for very large sizes, such as 16-in. O.D. by $1\frac{9}{16}$ in. wall (schedule No. 160), the ordinary mill setup used for rolling 16-in. O.D. pipe of nominal wall thickness is not satisfactory, and it is necessary to adjust the first and second piercers, use a different Hi-mill bar and plug, change the reeling machine, and sometimes change the sizing rolls. In addition, the billet weight for such a pipe size is so heavy, often over 6000 lb., that the heating furnace will not accommodate the desired round billet diameter because of excessive length. This requires the use of a billet of greater diameter than normally required in order to keep the length within the heating furnace limit. On account of this, the piercing mill passes used for ordinary 16-in. O.D. pipe cannot be employed.

As a result of these conditions, extensive changes and rearrangement of rolling equipment always become necessary when one of the sizes of special heavy-wall pipe is to be made, either when the pipe mill has previously been rolling a similar diameter with a light wall, or a smaller diameter. It takes from 3 to 5 hr. to change the mill setup, and the cost of this nonproductive delay is very high. During these mill changes, furnaces are lit and operated, and the full mill crew of approximately fifty men is engaged in the rearrangement. After the rolling of the special heavy pipe, a similar set of mill changes is required to go back on the production of normal pipe sizes.

Orders for large-diameter and heavy-wall pipe rarely exceed 1000 ft. and this represents only forty pieces 25 ft. long. Such a quantity can ordinarily be rolled in 1 to 2 hr. It is evident that the total mill time employed in producing 1000 ft. of a special size would approximate 10 hr., estimating 4 hr. for setting up the mill, 2 hr. for rolling the special pipe, and 4 hr. for changing back to standard pipe mill setups. The operating costs and overhead charges per ton for producing such quantities in these sizes are often from five to ten times those for producing a given quantity of ordinary pipe and tubing sizes.

The cost of these rollings is increased when expensive alloy steels are used for making the heavy-wall pipe because the loss of one or more of the 2 to 3-ton billets is quite high. It is therefore always necessary to run pilot billets of carbon steel of the same size in order to check the mill setting and obtain satisfactory tubes before starting on the rolling of the more expensive alloy steel. These tests or pilot rollings result in material which does not apply on any orders and frequently has to be scrapped or carried in stock for long periods.

It has seemed desirable to set forth these manufacturing details in regard to these special pipe sizes since practically all the purchasers of this pipe cannot understand the difficulties and also fail to see why orders for 80 ft. of $12\frac{3}{4}$-in., O.D. by 1.312-in. wall cannot be taken as readily as orders for 80 ft. of 6-in. standard pipe. The answer to this is quite obvious as 6-in. standard pipe is rolled in large tonnages representing several hundred thousand feet at a time, from which small lots can readily be cut and shipped. Large rollings of special analysis and special large-diameter heavy-wall pipe are never made since they are not standard purchases. Overages of these odd pipe sizes cannot be immediately sold, and frequently must be scrapped. It is for this reason that pipe manufacturers have generally insisted that rollings of the dimensions discussed herein should be limited to minimum quantities of 1500 ft. and, even in this small quantity, the costs for mill changes and operating time become excessive.

In addition, the rolling of these sizes on the mills is extremely difficult and frequently a number of pieces are cobbled or lost due to difficulties in handling the heavy billets and to the lack of experience of the mill crews in setting the mills and operating them to the best advantage. In a sense these tube sizes are special forgings and their manufacture is definitely a custom-made proposition. The yield or practice is considerably less than

that obtained on ordinary pipe rollings, and this makes it difficult to produce material in these sizes to any given cut length. The manufacturers have therefore adopted the attitude that only random length pieces will be made in such sizes, and that short lengths down to 6 ft. may be cut. Moreover, the maximum lengths that can be rolled are definitely limited by the billet weights that can be heated, and it is practically impossible to roll any lengths over 30 ft.

Due to the fact that these special heavy-wall alloy steel tubes are used for very high pressure and temperature conditions, the inspection of the finished material is the most severe that is encountered in the pipe industry. It is necessary to pickle or descale the surface of the metal in order to develop the defects, and then a considerable amount of grinding is required for the removal of pits, scratches, and light seams. Frequently a long length over 20 ft. must be cut in the center to remove a defect, and this will leave two short lengths, sometimes less than 10 ft. of good material. It is mainly on account of the severe inspection that the mills insist on shipping short lengths down to 6 ft.

Specifications A 206 have been changed every year since they were originally written in 1937. This situation has made it impossible for manufacturers to stock any amount of these special heavy-wall large-diameter pipe sizes, and at the present time the profound changes in chemical analysis and steel melting practice which are being considered for these specifications make it utterly impossible to consider any stock for at least the next 2 yr. It will therefore become evident that this material as ordered will have to be made by direct rolling, and under present volume demand for pipe the scheduling of such orders as 200 ft. of 14-in. O.D. by 1.406-in. wall is impractical.

As a result of the complexities involved in the manufacture of this kind of pipe it has become evident to National Tube Co. that the only way in which such special pipe can be manufactured on any basis approaching a commercial production operation is to standardize on the following features:

1. Roll only certain wall thicknesses, such as schedules Nos. 120 and 160, for any given diameter.
2. Roll only one length in any given diameter and wall thickness.
3. Purchase billets of only one diameter and weight for rolling each size of pipe. This will enable the mill to produce one standard length of pipe in each size.

The significance of these proposals is outlined in detail in Table I. For example, on the $12\frac{3}{4}$-in. O.D. by 1.312-in. wall (schedule No. 160), the mill would only purchase round billets 12-in. O.D., 4960-lb. weight, and only roll one length of pipe 31 ft. long, which would cut to 25 ft. after making the supplementary tests usually required for this material. No longer lengths in this size would be produced and shipments of pipe from such rollings would range from 6 ft. to 25 ft. Obviously different seamless mills cannot roll the same length in a given size, and the other manufacturers may have some longer or shorter standard length. It is suggested that such a table be incorporated in A.S.T.M. specifications for these pipe sizes instead of the present American Standard B 36.10–1939 as the manufacture of all the twenty sizes of pipe between $10\frac{3}{4}$-in. O.D. and 16-in. O.D. and schedules Nos. 80 to 160 would make it impossible for mills ever to accumulate commercial stocks in all these sizes. Schedules Nos. 120 and 160 in Table I were merely entered as a suggestion, as these seem to be the most common thicknesses. It may be that consumers would have a preference for some other two walls, which may be debated in committee meetings.

Having adopted these uniform conditions it will be possible for the mill gradually to accumulate a stock of round billets suitable for rolling a given pipe size. The rollings on the pipe mill must be limited to minimum quantities of 1500 ft. This will make it necessary for consumers to purchase such a quantity or have their orders for lesser amounts accumulate at the producer's plant until a sufficient number of orders to total 1500 ft. are entered to initiate the rolling. Any excess from these rollings can then be placed in stock in the standard lengths, much like ordinary pipe is stocked. At the time when such stocks are accumulated in the standard diameters and wall thicknesses, orders for small quantities may be entertained by cutting small amounts from such stocks. This situation, however, will never be reached until a definite and standard specification in the A.S.T.M. is written and adhered to without annual changes.

Memo on Cavitation

By Frank N. Speller[1]

Cavitation of metals as found in runners of hydraulic turbines and centrifugal pumps, is caused mainly by the sudden collapse of vapor-filled cavities formed in the water as it passes through low pressure sections of the conduit. When a string of these bubbles or cores of vortices in contact with the metal reaches high-pressure areas the bubbles collapse causing a powerful impact which resembles water hammer. These rapidly repeated blows on limited areas result in the disintegration of the metal. It is not known how the metal becomes detached in powdered form as has been found to occur in laboratory tests. We all know that ductile metals such as some bronzes and 18 per cent chromium, 8 per cent nickel low-carbon stainless steel are work hardened. Laboratory experiments (**2**)[2] at a rate of

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[2] The boldface numbers in parentheses refer to the list of references appended to this paper, see p. 22.

impact far greater than in the Venturi apparatus show much less loss of weight on austenitic stainless steel sheets under this hydraulic impact after the thickness has been reduced to one half of the original gage or less by cold work.

Cast iron which is brittle and cannot be cold worked is more rapidly destroyed by cavitation stresses than the more ductile steels. Austenitic stainless steels (18–8) which stand a relatively large amount of cold work and are highly resistant to corrosion are also relatively resistant to cavitation stresses which would cause rapid pitting in carbon steel or cast iron.

Cavitation evidently stresses the metal locally beyond its elastic and fatigue limit. Local fatigue probably accelerates the mechanical failure at or just below the surface where the metal is subjected to shear stresses. Where the metal surface contains fissures or is porous, some think that water or water vapor is forced into such crevices under high pressure causing shearing stresses (**15**). Possibly the metal may be pulverized by repeated hammering as in production of aluminum powder.

There has been much speculation as to know how much corrosion has to do with cavitation effects. It is generally known that austenitic stainless steels are much more resistant to cavitaton. This is probably due both to their resistance to corrosion and to their susceptibility to cold work. In short-time laboratory tests of a few hours, corrosion hardly has time to play much of a part except as it accelerates damage from fatigue—which may be quite an important factor.

Corrosion in water high in dissolved oxygen is greatly accelerated by removal of surface-protective films or corrosion products. Galvanic effects by localized stresses in the metal are also powerful accelerators of corrosion as is also the high velocity of the water which brings fresh oxygen-saturated water to the metal surface.[3] All these electrochemical effects are present in low-pressure areas that are subject to cavitation stresses.

Sizable tubercles of rust form in a matter of a few weeks over incipient corrosion pits in many waters. It has been observed by Hess (**11**) that cavitation pits have been found to occur just back of hard corrosion tubercles when the velocity and pressure conditnios were favorable. A raised tubercle may touch off the collapse of bubbles in the water as they move by. Or if corrosion tubercles have had a chance to form due to a period of stagnant or low velocity water, the bombardment which is sufficient to cold work steel should certainly expose clean metal and extend corrosion pits, and these depressions tend to accelerate the effect of cavitation stresses.

Whatever the actual mechanism may be, corrosion and corrosion fatigue, high velocity, and the removal of all protective metal surface films all appear to play an important part, although the main damage from cavitation is due undoubtedly to the rapid and powerful dynamic impacts thereby produced.

The remedies for this trouble agreed upon by hydraulic engineers include more favorable setting of the turbines or the pump with respect to the pressure heads which will not be discussed here. The injection of air into the water at proper points has been found to reduce the damage materially, as the excess air is not taken up immediately, as is water vapor, when the gas-filled bubbles collapse and thus has a cushioning effect. In the design of metal parts subject to cavitation, sudden changes of curvature and rough surface finish must be avoided. Finally, corrosion-resisting metals such as austenitic stainless steel have given much longer life under cavitation and have been used for several years in the repair of damaged sections of runners and pump vanes by fusion welding.

[3] The velocity of impact probably accelerates corrosion tremendously.

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Metal Cleaning: I—Indirect Performance Tests

By Jay C. Harris[1]

Cooperators:

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The consideration of methods and specifications for the field of metal cleaning is a complicated one because of the variety of metals and metal finishes, as well as the infinite variety of soiling agents which may be encountered. It has been suggested that specifications for metal cleaning and metal cleaners may best be developed by investigating each problem individually. Ultimately this line of attack will be followed, but a knowledge of available evaluation methods could simplify the problem materially.

This paper has been prepared in order to provide information regarding suggested or currently used evaluation tests in readily available form. Although some one test may be suggested as suitable, specific conditions may invalidate it, and other conditions may have to be observed. Consequently, the various information given in this paper should in no sense be considered as a recommendation, since no specifications have as yet been developed. In fact, it is hoped that this publication will result in constructive criticism which will further the work of Section G on Metal Cleaners of Subcommittee II on Specifications of Committee D-12 on Soaps and Other Detergents.

Evaluation Methods

The evaluation of metal cleaners is complicated by the fact that it is not always possible to make pilot plant or full-scale trials, and, when the evaluation is made in a laboratory other than that of a specific plant, there is considerable doubt regarding either the specific soil used in the removal tests, or the utility of a metal cleaning composition for any than the specific soil upon which the cleaner was tested.

There are two general methods of evaluation approach:

I. Indirect performance tests including analyses may be developed, or, more directly,

II. Soil removal performance methods may be employed.

This paper is concerned with the indirect method of approach, which is the logical one in the absence of knowledge of the soil, standard or otherwise, to be removed and of the conditions under which the cleaner may be used. A later paper will deal with the second general method as Part II of this discussion.

Even though a well-defined soil and method of removal may be available, indirect chemical or physicochemical methods may be of decided value in defining qualities desired in a cleaning bath. Such methods will serve to differentiate between products which might otherwise prove closely similar under the soil removal method, and will assure desirable properties not otherwise measurable. Such methods may also prove useful in control of the cleaning baths.

Before an examination of the indirect performance tests is made, it is pertinent that the general metal cleaning processes be examined to determine in a general way what conditions and materials may be encountered.

Cleaning Processes

Metal cleaning processes may arbitrarily be classified as follows (**98**):[2]

1. Wiping (by hand or machine).
2. Brushing (by hand or machine).
3. Sand blasting.
4. Tumbling.
5. Hydraulic spraying.
6. Steam gun spraying.
7. Dipping in still tank.
8. Machine washing.
9. Electrolytic cleaning (anodic or cathodic).
10. Continuous acid or alkaline dip.
11. Vapor degreasing.
12. Solvent degreasing.

To this may be added (**91**):

13. Emulsion degreasing:

(*a*) Organic solvent containing oil-soluble emulsifying agent.

(*b*) Organic solvent containing oil-soluble emulsifying agent mixed with kerosene and solvent to form emulsion.

General Types of Cleaning:

The main general types of cleaning, however, may be reduced to the following:

1. Soak tank cleaning.
2. Mechanical tank or spray cleaning.
3. Electrolytic cleaning (anodic, cathodic, alternate current).
4. Solvent or vapor degreasing.
5. Emulsion degreasing.

The requirements of these types of cleaning will define the specifications of the detergents used therein. Consequently analytical methods or performance tests may be developed which will cover certain of the requirements of the above cleaning methods.

Performance Tests

The more generally investigated performance tests are:

pH and titration values,
Colloidal properties,
Water softening,
Conductivity,
Solvent action,
Surface and interfacial tension measurements,
Emulsification,
Rinsability, and
Stability under conditions of usage.

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[2] The boldface numbers in parentheses from Nos. 1 to 209 refer to the "Annotated Bibliography of Aluminum Cleaning," ASTM BULLETIN, No. 120, January, 1943, p. 33; No. 121, March, 1943, p. 33; and No. 128, May, 1944, p. 35. References from No. 210 on are appended to this paper. A combined bibliography will be included in the A.S.T.M. Standards on Soaps and Other Detergents (1944). (Issued as separate publications.)

The initial approach to this problem is to ascertain the availability of methods for analysis, specifications, and performance methods such as those listed above.

Analytical Methods

Many metal cleaning compositions may be analyzed by standard procedure used for alkalies, but where mixtures of materials are used which may comprise caustic alkalies and the many alkaline salts, soap, rosin, synthetic wetting agents and detergents, corrosion inhibitors and sulfonated oils, difficulties will be encountered with standard procedures. No attempt has been made extensively to cover the literature on this subject, but a method (**135**) has been developed for the determination of caustic soda, soda ash, trisodium phosphate and sodium sulfate in the presence of the others. Standard Methods of Chemical Analysis of Sulfonated and Sulfated Oils have been published by the Society (**210**). Methods of Chemical Analysis of Industrial Metal Cleaning Compositions (**167**) have also been published by the Society. The latter reference covers the only series of methods especially designed for the examination of metal cleaning compositions, and is valuable where chemical control of purchases is desired and where the utility of a material for plant use has already been proved. No value would accrue from attempts to cover these methods in detail since they are readily available and are self explanatory.

Methods for Sampling and Chemical Analysis of Special Detergents (caustic soda and the alkaline salts) is another A.S.T.M. standard (**211**) of potential value to the metal cleaning trade.

Methods of chemical analysis and control can be used in defining the quality of chemicals purchased as such, rather than in mixtures, and considerable effort has led to specifications for many of these agents.

Specifications

Chemical specifications are available (**63, 3, 212**) for many of the individual alkaline salts and for organic solvents used in metal cleaning, and can be of considerable use in the purchase of materials used in the cleaning department.

Chemical analysis and specifications may be of considerable value in controlling the quality and purchase of cleaning compositions or their constituents, but leave much to be desired in the use evaluation of such materials or their mixtures. The literature reveals many attempts to measure the properties of cleaning compositions and clearly indicates the necessity for so doing if optimum cleaning results are to be attained. There are many phases to such evaluation, so that for purposes of simplification they have been condensed wherever possible.

The performance tests which follow are from the sources indicated, and are what seem to be the methods most applicable to metal cleaning control. While there may be so-called "simple" tests which seem to be suitable for evaluation, the chances are that these "simple" tests fail to control certain important factors, resulting in data which are in grave error. On the other hand, the refinements of technique obtained through the use of complicated or expensive equipment are not indicated where the art has not progressed sufficiently that the data obtained have significant effect upon the end results.

pH and Titration Values

Many cleaning compositions are alkaline in nature and possess properties which are easily measured. The earlier control work on cleaning baths was carried out by determination of the relative alkalinity of the bath by titration methods (**33, 47, 54, 101, 107, 116**). Differentiation may be made between active and inactive alkali by titration methods (**116**), and has been also used for control by the laundry industry for many years. Unfortunately, alkalinity is not necessarily a means for comparison between two alkalies or products to be used for cleansing, since each material will have its own degree of soil removal activity regardless of difference in alkalinity characteristics.

Another indication of relative strength of alkalinity is measurement of hydrogen-ion (pH) concentration, which has become increasingly simple and accurate (**47, 54, 97, 101, 107, 116**). Unfortunately, neither titration values nor pH values are a full indication of utility. However, a combination of the two is highly useful. Of even greater value is determination of the buffering action of a material, since if a material had high initial pH value but this value is susceptible to marked changes either with a small amount of acidic material or changes markedly upon dilution, it could be expected that the bath efficiency might drop markedly. A highly buffered material is then one which maintains nearly its initial pH value over a considerable range, either upon the addition of acid or alkali to it, or upon dilution. Such information is highly valuable, and can readily be determined by titrating a standard solution of the mixture with a standard solution of acid or alkali, measuring the pH values at given intervals of addition.

That such values are of importance in specifications for metal cleaning compositions is indicated by the fact that several Federal specifications (**213, 214, 215, 216**) require such measurements.

In general there are two systems available for pH measurement; these are either colorimetric or potentiometric. For many purposes the colorimetric method may be suitable, and either paper or liquid indicators covering the pH range are available. Presence of interfering substances may dictate the use of one indicator over another. It is a desirable precaution to check the colorimetric indicator against the potentiometric system since the presence of certain chemicals may lead to error. The potentiometric means for pH measurement presents the choice of a variety of equipment. In general the glass electrode system has proved most readily useful since they may be used under a variety of conditions such as high temperature and high pH work, but where so used, the proper corrections must be made.

Titration of alkaline or acid solutions is the time-honored method for estimation for strength of solution, and differentiation between "active" and "inactive" alkali may be made by choice of indicator (phenolphthalein and methyl orange, respectively).

In the evaluation of an alkaline or acidic material it may be advanta-

geous to prepare a pH-titration curve. In doing so, due care should be used in the choice of solution strength and in the rate of addition of acid (or alkali) that the deflection points are fully covered.

Colloidal Properties

The colloidal properties of the various alkaline salts vary immensely. The importance of colloidal dispersion (**81, 101, 116**) of soil or its adsorption (**101**) and peptization (deflocculation) (**45, 101, 105, 117**) has not been overlooked, and methods for measurement are to be found in two Federal specifications (**217, 218**). In general, materials exhibiting any detersive action will tend to disperse carbon or other particles, though it may be difficult to differentiate between the means for producing the effect whether it be adsorption, peptization, or deflocculation.

Numerous investigators in the detergent field have tested the deflocculating action of soaps, alkalies, and wetting agents against carbon black. The test may be carried out in various ways, of which the following is representative (**218**):

0.250 g. of Norit carbon (SAU-30 or C grades) must be wet out by 50 ml. of the 4:100 dilution within 10 min., when the test is made as follows: Place the carbon in the bottom of a dry 1-in. test tube. Using a 50-ml. pipette, transfer the solution into the bottom of the test tube, holding the pipette against the side of the test tube. Withdraw the pipette gently and note the time for carbon to wet out spontaneously and motion to cease. The tube must now appear black throughout. Shake the tube. At the end of 24 hr. of standing, there must still be carbon held in suspension.

Water Softening

Another important property of the agents used in metal cleaning is to condition the water, either by softening it (**75, 116**) by forming a soluble complex with the calcium and magnesium ions present, or by forming soluble or insoluble calcium and magnesium salts of the compound in use. The presence of synthetic detergents in metal cleaning compositions introduces considerable difficulty in the usual water-softening determination, since soluble calcium and magnesium compounds may be formed obscuring the usual lather end point. But with this interference recognized, a water softening test is used for evaluation in a number of Government specifications (**216, 217, 219**).

One performance test of marked importance in alkaline solutions, especially in areas where hard water is used, is their resistance to decomposition by the hard water elements. In the first place hard water should be softened through their use, and the amount of agent required for the softening action should be a minimum, since the balance of the agent used will presumably be employed in soil removal.

The use of synthetic detergents has complicated the picture somewhat, since many of them are essentially unaffected by hard water, whereas soap readily forms troublesome, insoluble, and oftentimes sticky curd. This would seem to indicate the use of one of three tests: (1) when soap and synthetic agent are absent, (2) when soap alone is present, and (3) with synthetic detergent alone or admixed with soap.

A suitable test (**213**) for use in the absence of synthetic wetting agent or detergent and soap follows:

Preparation of Standard Hard Water.—Transfer to a 500-ml. graduated flask the calculated amount of reagent-grade calcium acetate, monohydrate (accurately weighed and based on an accurate determination of its calcium content), equivalent to 0.4275 g. of calcium carbonate. Dissolve in distilled water from which carbon dioxide has been removed by boiling, make up to 500 ml. with CO_2 free water, and mix. (One milliliter of this solution should contain the equivalent of 0.855 mg. of calcium carbonate.) Prepare a 5 per cent solution of the detergent under test by dissolving a 50-g. portion of the well-mixed sample in distilled water (heat may be used if necessary); cool to room temperature, make up to a liter with distilled water, and mix. Transfer 50 ml. of the standard calcium acetate solution to a 250-ml. volumetric flask, add 100 to 150 ml. of CO_2 free distilled water (depending upon the volume of detergent solution to be added); then add the concentrated detergent solution in the amount recommended for 250 ml. of water having a hardness of 10 grains (171 parts per million) per gallon, and dilute to the mark with distilled water from which the carbon dioxide has been removed by boiling. This solution now contains the equivalent of 10 grains per gallon of calcium carbonate and the recommended amount of detergent to be used for water of this hardness.

Note.—In adding the detergent solution, use a graduated pipette and shake the bottle containing the solution so that any undissolved portion will be uniformly distributed throughout the solution.

Note.—Most hard waters contain both calcium and magnesium as the hard water constituents, and it is generally conceded that the chloride and sulfate, respectively, are most suitable.

Water-Softening Capacity.—Prepare 250 ml. of water containing the equivalent of 10 grains per gallon of calcium carbonate and the recommended amount of detergent as described above. Heat this solution to a temperature of 155 F. and stir vigorously to distribute any precipitate. Without cooling, pipette 50 ml. into a 250-ml. Pyrex glass-stoppered, round bottle at room temperature. Add 1 ml. of the American Public Health Association's standard soap solution,[3] shake vigorously, let stand (with bottle on its side) for 5 min., and again shake vigorously. A continuous lather that persists over the whole surface for 5 min. or more after the second shaking indicates that the water has been softened completely.

A test designed to estimate the ability of an agent to prevent precipitation of calcium and magnesium compounds follows (**216**):

Standard Soap Solution.—The Standard soap solution employed shall be as specified by the American Public Health Association.[3]

Calcium and Magnesium Chloride Solution.—Prepare a solution in distilled water, containing calcium chloride and magnesium chloride equivalent, respectively, to 9.37 mg. of calcium carbonate and 6.50 mg. of magnesium carbonate per ml. This solution should be prepared by dilution of more concentrated stock solutions of calcium chloride and magnesium chloride which have been accurately analyzed. The deviation from the specified concentrations should not exceed 1 part per 100.

Lime Soap Dispersion Test.—Pipette 100 ml. of stock solution of the sample and 100 ml. of distilled water into a 250-ml. beaker. Pipette 2 ml. of standard soap solution into the beaker containing the solution of the sample and stir until the solution is mixed. With constant stirring, slowly add 2 ml. of standard calcium and magnesium chloride solution, measuring the volume accurately by means of a 2-ml. pipette. Cover the beaker with a watch glass and heat in an oven at 60 ± 5 C. for 30 min. Remove the solution from the oven, cool to room temperature, and filter through a prepared and weighed asbestos

[3] Standard Methods for the Examination of Water and Sewage, Eighth Edition, American Public Health Assn.

felted Gooch crucible. Wash the beaker and precipitate with several small portions of hot water, transferring the precipitate quantitatively to the filter. The total volume of wash water used should not exceed 25 ml. Dry the crucible and contents at 100 to 105 C. Cool the crucible in a desiccator and weigh. Drying and weighing should be repeated until the difference between successive weights is not greater than 0.3 mg.

Conductivity

The property of conductivity may be of especial interest in metal cleaning by electrochemical means (**48, 81, 101, 174**). The greater the degree of conductivity, in general, the greater the evolution of gas and the more rapid the cleaning process. It is indicated that the current-carrying capacity is of more importance for steel cleaning than for the softer metals where less vigorous action is required. Foam is a problem in electro cleaning, and conductivity measurements alone are not a sufficient means for evaluation. However, a convenient laboratory setup for the evaluation of such metal cleaners has been developed (**174**).

Conductivity may readily be measured by means of a conductivity bridge (**235**) and suitable cell. The results as obtained may be expressed as specific conductivity. Precautions should be taken with a series of comparison samples to adjust them to constant temperature.

Solvent Action

Certain types of soil may most effectively, safely, or economically be removed by solvent or vapor-degreasing (**1, 10, 11, 15, 21, 34, 44, 45, 58, 60, 76, 94, 98, 137, 138, 144, 146, 149, 152, 183, 185, 187, 188**), or by emulsion degreasing (**41, 91, 98, 139, 185**). Several Federal Specifications are concerned with organic solvents for solvent or vapor degreasing (**220, 221, 222, 223, 224**) and with emulsion degreasing (**225, 226, 227, 228, 229, 230**).

It is apparent that solvent action can best be determined by actual trial. A specific example (**221**) follows:

Oil Removing Properties.—A 3 by 6-in. anodized aluminum alloy panel shall be coated with S.A.E. No. 50 oil, and completely immersed in the solution. The time required to remove the oil shall be observed.

Surface and Interfacial Tension Measurements

Most effective cleansing is generally obtained when the wetting of the surface being cleansed, or surface or interfacial tension of the cleaning solution is maintained at an optimum (**10, 13, 45, 101, 189**). The wetting efficiencies of cleaning solutions has been determined by the drop method (**93**) but a quicker and more generally reliable method is through use of the DuNouy tensiometer. The concept of reduction of interfacial tension between cleaner solution-oil interfaces (**8, 82, 105**) suggests its measurement as a means for evaluation and control. This end may be accomplished by using a stalagmometer, but more readily by using the interfacial type of the DuNouy tensiometer.

Various methods for the determination of surface or interfacial tensions have been used in Federal specifications (**214, 215, 217, 218, 219, 231, 232**).

Measurement.—Surface tension can be measured in a number of ways, for example by capillary rise or by the drop weight method, but both of these methods require considerable care in manipulation. One of the simplest and most rapid method of measurement is the use of the DuNouy tensiometer. This method is required by numerous Government specifications. Ordinarily the measurements are made either at a single concentration (that recommended by the manufacturer of the cleaner) or at a series of concentrations, preferably under controlled temperature conditions.

Calibration of the DuNouy instrument (**237**) is easily accomplished, and where high accuracy is desired, correction factors have been developed (**238**).

Interfacial tension measurements can be determined in several ways among which the stalagmometer method and the DuNouy ring method are probably the most popular. Again the DuNouy apparatus is the most rapid means for measurement, though the determination is somewhat more difficult than for surface tension against an air interface. It has been the custom in these laboratories to use Nujol as the oil involved, though where a specific oil is encountered in a plant, this could as readily be used.

Emulsification

An indication of the ease of emulsification is the interfacial tension measurement of the cleaner solution against an oil, preferably that to be removed. More direct indications (**10, 33, 45, 84, 101, 105, 117**) of emulsifying ability are obtained by actually determining the emulsifying activity of the cleaner solution and the degree of stability of the emulsion produced.

The ability of the emulsion degreasing agents to remain in suspension is an important factor in proper cleansing and tests for estimation of this characteristic are given in several Federal specifications (**227, 228, 229, 230**).

Emulsion stability of solvent emulsion type cleaners (**230**) is ascertained by dilution of the cleaner with solvent and then with water and recording the degree of "creaming" or breakdown of emulsion. Stability of emulsion formation has been tested (**228**) by adding a given volume of lubricating oil to the emulsion cleaner in an open Petri dish.

A recently developed centrifugation method (**236**) can be used for a quantitative estimation of emulsion stability.

In the evaluation of emulsion cleaners it is important that the detergent be stable to water, and to extreme dilution with Stoddard solvent, kerosine or other organic solvent used.

When soak cleaner baths are used it is likewise important that adequate emulsification be produced, since otherwise the greases, oils, and other contaminants removed might float to the surface of the bath and contaminate the piece being cleaned at the time it is withdrawn to the rinse tank.

Therefore two general types of test are indicated: One to determine the stability of emulsion cleaners to dilution and to water, and another for aqueous cleaning baths either upon dilution, or overloading of the bath. It has been suggested (**75**) that emulsifying power may be ascertained by using butter fat as the oil phase and determining stability of emulsion. Another suggestion

(**107**) is that the emulsifying power of a cleaning bath be evaluated by adding known increments of either mineral oil or lanolin to the bath in question, bringing about emulsification then permitting the baths to stand and observing them for separation. Still another suggestion (**116**) for evaluation is to measure the time for removal of mineral or vegetable oils from brass disks under controlled experimental conditions.

A suggested stability test for emulsion cleaners (**230**) follows:

Stability of Emulsion.—Place 5 ml. of the material into a 50-ml. graduated cylinder having a ground glass stopper. Add 45 ml. of kerosine (kerosine shall be in accordance with Federal Specification VV-K-211). Stopper cylinder and shake thoroughly. Maintain temperature conditions at 70 to 90 F. The material shall readily disperse or dissolve in the kerosine to give a clear liquid without the presence of undissolved matter. Pour 5 ml. of the thinned material into another similar graduated cylinder and add 45 ml. of distilled water. Stopper and shake thoroughly. A creamy emulsion shall result. Allow to stand undisturbed for 24 hr. at temperature conditions of 70 to 90 F. Examine the cylinder after this period. There shall be not more than 10 per cent "creaming" (floating or settling out of a layer of emulsion) with no breakdown of the emulsion.

A further test of emulsion cleaners (**228**) utilizing addition of an oil to indicate stability follows:

Homogeneity.—Place 20 ml. of the cleaner in a 4-in. Petri dish. Add to this, without agitation, 5 ml. of Grade S.A.E. No. 70 lubricating oil or No. 6 fuel oil. Run the test at room temperature. The oil shall be completely dispersed throughout the cleaner. Swirl for a moment or two and place the solution in an open Petri dish. Examine after 48 hr. at room temperature. A homogeneous solution shall be formed which shall show no separation.

A test (**107**) utilizing the observation of emulsion stability can be carried out as follows:

Emulsion Stability.—Prepare a 30 per cent by weight solution of commercial lanolin in mineral spirits or Stoddard solvent. Add 5 ml. of this solution at room temperature to 95 ml. of cleaner solutions at varying concentrations. Homogenize in a standard manner, transfer to a 100-ml. graduated cylinder and note the time for separation of oil globules.

Rinsability

The function of a detergent is to assist in the removal of soil from the surface to be cleansed. To be a suitable detergent and to leave a perfectly clean, unaffected surface, the cleansing agent should preferably be unreactive with the surface being cleansed, should not be adsorbed by the surface, hence should rinse freely. There are many cases where reaction with the surface being cleansed may be both desirable and beneficial, but these are special cases, and most generally no remaining detergent is desired. The importance of rinsing tests has been mentioned (**101, 105, 116**) and a number of Federal specifications contain tests designed to measure this property (**213, 214, 221, 225, 231, 232, 233, 234**).

The ease of rinsability of the numerous compositions used for metal cleaning may vary widely, even though thorough rinsing may have an important bearing upon subsequent processing. It is a fairly well-known fact that chemicals have varying degrees of affinity for metal or other surfaces. What is often termed "chemical cleanliness" may be a misnomer, since a chemical film, possibly of monomolecular thickness, may be retained on the surface cleaned. It has even been suggested that absence of "water break" may be due to such a film which is easily wet by water.

Since ease of rinsability and relatively complete freedom from contaminant from the cleaning bath is desired, suitable tests should be available for determining this factor.

Two specifications (**214, 232**) contain the same test for rinsability:

Test for Rinsing Properties.—Completely suspend for 5 min. a 4 by 6-in. glass panel in a beaker containing 1 liter of solution of the stripper, maintained at 85 to 95 C. Remove and dip completely twice in a beaker containing 1 liter of tap water at 70 C., allowing to drain 10 sec. between dips. Observe presence or absence of "water breaks." Allow to dry for 2 hr. at room temperature at an angle of 45 deg. Observe any evidence of residue. Add a drop of c.p. alcohol to the surface, allow to evaporate, and notice any evidence of a white deposit. The absence of "water breaks" at the dip, and of a residue on drying, and the failure to form a white deposit on evaporation of the alcohol, shall indicate a suitably clean surface.

Two other specifications (**231, 233**) give essentially the same test except for variations in concentration and temperature of cleaner, and the fact that the test panels are permitted to dry for 15 min. prior to water rinsing.

It may be possible to utilize a contact resistance measurement (**186**) in the determination of cleanliness.

Stability Under Conditions of Usage

The usual difficulty with a laboratory method of evaluation is that no attempt is made to exhaust the bath, measuring the ability of the detergent to withstand long usage, heat, aeration, sedimentation, and perhaps overloading of the bath with oils and soil. The need for such a test is evident (**101, 107, 116, 117, 189**), but development of a suitable test to evaluate this property is difficult because of the many types of soil and operating conditions involved.

Summary

It is to be understood that none of the foregoing tests are to be considered as recommended methods. Many of them simply are in use in certain specifications as a means for controlling some desired quality. The object in reviewing these test methods is to make them available for future use, to indicate the extent to which such tests are resorted to in defining qualities of cleaning compositions, and, if possible, to develop constructive criticism.

Cleaning processes are classified as these general types:

1. Soak tank cleaning.
2. Mechanical tank or spray cleaning.
3. Electrolytic cleaning.
4. Solvent or vapor degreasing.
5. Emulsion degreasing.

Available analytical methods and specifications are outlined.

The performance tests which are considered, and their general applicability, follow:

pH and Titration Values.—Methods and equipment readily available and satisfactory.

Colloidal Properties.—Tests are available, but are very specific in character.

Water Softening.—Methods are available for soap or soapless composition, but tests in the presence of synthetic foaming agents have not been developed.

Conductivity.—Methods for measurement are available, and a practical method for test can be used.

Solvent Action.—This is a specific property but apparently of considerable value.

Surface and Interfacial Tension.—Equipment is available and can be used as a means for controlling the amount of surface-active agent present.

Emulsification.—Tests for this property are very specific though apparently of considerable value.

Rinsability.—This property is very important and many tests have been devised, but is difficult to measure suitably (considering the multitude of possible surfaces).

Stability Under Conditions of Usage.—It appears that short of actual trial there is no readily applicable general tests for this quality of a bath.

There are a number of performance tests already in use which may be applicable either directly or with alteration to define desired properties of cleaning compositions and it is not suggested that these can be used as the sole criterion of utility.

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Infrared Spectroscopy

This book, entitled "Infrared Spectroscopy, Industrial Applications and Bibliography," issued in 1944 by the Reinhold Publishing Co., 330 West Forty-second St., New York, N. Y., is intended as a partial answer to the increasing demand for information on infrared spectroscopy. The theory of infrared absorption and its relation to molecular structure are discussed to provide the essential background for detailed descriptions of techniques useful in analysis. Finally a library of 363 representative spectra of organic compounds taken in the rock salt region of the infrared spectrum is presented for comparison with those obtained from unknown compounds under investigation.

The library of reference curves, covering some sixty pages, is followed by an empirical formula index and an alphabetical index to these reference curves and then by a very extensive bibliography comprising 2700 references. To make this mass of information most helpful, there is a subject index which under appropriate headings gives a list of the entries in the bibliography.

The book (236 pages, 6 by 9 in.) was prepared by Messrs. B nes, Gore, Liddel, and Williams, Stamford Research Laboratories, American Cyanamid Co. Copies of the book can be obtained from the publisher at $2.25.

Navy Research

A report on the Naval Ordnance Laboratory indicates the important part research has had in the war program. Outstanding scientists, in particular authorities concerned with electrical and magnetic problems, have for many months had intense work under way, including degaussing studies and problems involved in under-water war. The new laboratory buildings, part of a $5,000,000 project at White Oak, Md., are under way with the main laboratory nearing completion and several of the magnetics buildings started. Captain W. G. Schindler is the officer in charge of the laboratories.

Past History of A.S.T.M. Lubricating Grease Test Methods[1]

By H. A. McConville[2]

Committee D-2 on Petroleum Products and Lubricants, was formed in 1904 as A.S.T.M. Committee N on Standard Tests for Lubricants. Subcommittee (*e*) of this committee at that time was assigned the problem of determining cold test of oils and melting point of greases. A study of the committee reports for succeeding years until 1920 shows no mention of any tests being developed for grease, so it is assumed the subcommittee was not active.

In 1920 Subcommittee IV on Grease was formed with six members, G. Cash of the Standard Oil Co. of Indiana being chairman. In 1922 seven more members were added. During this year a Tentative Method of Test for Melting Point of Petrolatum (D 127 - 22 T)[3] was submitted by Subcommittee I under the chairmanship of F. R. Baxter. At this time petrolatum did not fall under the jurisdiction of Subcommittee IV. The committee, still under the chairmanship of Mr. Cash, put out a Tentative Method of Analysis of Grease (D 128 - 22 T).[4]

In 1923, a new chairman, R. E. Wilson of the Standard Oil Co. of Indiana, was appointed. That year the sub-committee worked on a test for consistency of grease. The New York Testing Laboratory's asphalt penetrometer was selected as the apparatus, with the substitution of a slightly truncated 45-deg. cone $1^1/_2$ in. wide at the top for the needle ordinarily used in that instrument. The total weight of the cone and shaft was to be 150 g. One interesting statement in the committee's report for 1923[5] was that variations in the temperature of the test cause the penetrations to vary roughly 0.5 per cent per 1 F. The test was conducted only on the unworked sample. In 1924 the committee debated the question of working the grease before testing. They also modified the method for grease analysis. In the appendix the Proposed Method of Test for the Penetration of Cup and Railroad Greases was published.

The Tentative Method of Test for Penetration of Greases (D 217 - 25 T)[6] was published in 1925. The shape of the cone was changed to the present double pitch and seemed to give less variations between laboratories than the old 45-deg. cone. Tables showing results of tests were published.

In 1926 a slight change was made in the method of analysis of grease. Modifications in wording were made in the methods for penetration and analysis of grease in 1927.[7] Some work was done to develop a method for melting point or flow point of grease.

No report was rendered in 1928 and 1929. The chairmanship of the subcommittee was held by R. R. Matthews for a short time, then was taken by A. R. Lange. The 1930 report showed that the committee was working on the method for melting point of greases, also making comparative tests on penetration of very soft and very hard greases.

During 1930 the chairmanship again changed to G. H. Harnden. No report was submitted in 1931 or 1932. The 1933 report gave results of tests on penetrations of hard greases. A paper by W. H. Herschel of the Bureau of Standards was published, giving a procedure for measuring bleeding of cup greases.[8] No report was published for 1934 or 1935.

The chairmanship of the subcommittee again changed to R. R. Matthews. The 1936 report showed that the committee was studying dropping point methods. Also a modification of the grease worker for the penetration test and a procedure for consistency of soft greases was considered. Certain parts of the analysis of grease method were studied.

In 1937 the subcommittee published a Proposed Method of Test for Dropping Point of Lubricating Greases.[9] There was also a minor revision of the analysis of grease method.

During 1938 the Tentative Method for Consistency of Lubricating Greases and Petrolatum (D 217 - 38 T) was rewritten[10] to show a new sketch and revised description of the penetrometer. No report was rendered in 1939. In 1940, under the chairmanship of M. B. Chittick, the subcommittee proposed a Tentative Method of Test for Dropping Point of Lubricating Grease.[11] A new method for determining water in grease was proposed, to be added to the analysis of grease method.[11] No report was published in 1941. In 1942, with F. E. Rosenstiehl acting chairman, the subcommittee recommended for adoption as a standard the Tentative Method for Dropping Point of Lubricating Grease (D 566 - 40 T).[12] No report was published in 1943.

So much for the published reports, which show that the subcommittee, until the time of its disbanding in June, 1944, had produced three test methods: Analysis of Grease (D 128); Penetration of Grease D217), and Dropping Point of Grease (D 566). Committee files available from 1927 on show the subjects that were presented for consideration. In 1927 the subcommittee was considering a G. H. consistency tester,

NOTE—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia 2, Pa.

[1] Delivered at the Organization Meeting of Technical Committee G on Lubricating Grease of Committee D-2 on Petroleum Products and Lubricants, Statler Hotel, Detroit, Mich., January 15, 1945.

[2] Chemical Section, Schenectady Works Laboratory, General Electric Co., Schenectady, N. Y.

[3] *Proceedings*, Am. Soc. Testing Mats., Vol. 22, Part I, p. 766 (1922).

[4] *Ibid.*, p. 768.

[5] *Proceedings*, Am. Soc. Testing Mats., Vol. 23, Part I, p. 350 (1923).

[6] *Proceedings*, Am. Soc. Testing Mats., Vol. 25, Part I, p. 701 (1925).

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[11] *Proceedings*, Am. Soc. Testing Mats., Vol. 40, p. 300 (1940).

[12] 1940 Supplement to Book of A.S.T.M. Standards, Part II, p. 208 (1940).

but the apparatus was not adopted. They were also requested to put out a method for determining percentage of graphite in grease.

During 1929 Mr. Herschel of the Bureau of Standards mentioned the need for a bleeding test and others wished methods for channeling, insolubility, and smoothness of grease. Mr. Herschel wrote in 1931 on the possible benefits of pressure flow investigations. In 1932 he again stressed the need for a bleeding test, and his paper on the subject, as stated before, was published as information in 1933.

In 1934 Mr. McConville mentioned the need for methods for certain properties, such as consistency of soft greases, water solubility, resistance to oxidation and the desirability of having a standard set of consistency ranges for greases. A method for adhesiveness of grease was submitted. Mr. Herschel stated that 60 strokes of the grease worker were not sufficient and that some greases might still thin down more with further working. Work was done trying out various instruments for measuring consistency of soft greases; among them the Abraham consistometer, Stormer viscosimeter, McMichael viscosimeter, Furol viscosimeter, Herschel burette consistometer and plastometer. Requests were received for measuring adhesiveness, range of oil viscosity in greases, and flow point.

A proposed change in the method for free acid or alkali using Alkali Blue 6B as an indicator was suggested in 1935, as was also an accelerated oxidation test. Other items mentioned were the Hoeppler and Brookfield viscosimeters, Gardner Parks mobilometer and pressure viscosity, also a plasticity apparatus, all for soft greases. Added to these were the McIntyre pan and the use of a light aluminum cone for soft greases. It was suggested that consistency tests be made at 100 and 221 F. for railroad greases. A Brinell type of apparatus for hard greases was described. A paper was published measuring the length of fiber in greases by the microscope and this was discussed.

In 1936 the A.B.E.C. penetrometer was brought out by the Annular Bearing Engineer Committee, also the A.B.E.C. grease testing machine. The modified Gardner-Parks mobilometer was considered for soft greases. A paper entitled "Analysis of Lubricating Greases" was submitted by Mr. Suit and some proposed changes in the method for chemical analysis of grease were proposed. A request for apparatus to test the color of greases was made.

Various pieces of apparatus were submitted by Mr. Knopf, such as the Consadometer and also the channel tester. Other subjects discussed were the use of McMichael viscosimeter and Hoeppler viscosimeter, a ball viscosimeter, also method for adhesiveness, the Norma-Hoffman stability test, oil bleeding, and a foaming test for gear lubricants in 1937.

In 1938 a comparison of channel testers for gear lubricants was made at the January meeting and a report submitted, but no action was taken. The modified Gardner-Parks mobilometer was still mentioned as an instrument for testing soft greases. The midget penetrometer developed by The Texas Company was submitted. A change was made in the method for determining water in grease.

A method for determining the percentage of oil in greases was submitted in 1939, also a method by The Texas Company for determining free acid and alkali in greases where both exist at the same time. Mr. McConville mentioned changes he thought should be made in the test for worked consistency, also methods on which work should be done, such as a test for oxidation resistance, corrosion test, solubility in water, and he mentioned work being done on vaporization loss.

In March, 1941, it was decided to investigate procedures for determining adhesiveness and also for the determination of free acid and free alkali coexisting in lubricating greases. Further revisions in the method for water in grease were also discussed.

During 1942 data were presented by Mr. Knopf showing possible errors in the method for consistency. The advisability of using mechanical grease workers was also discussed. A revised procedure for consistency of petrolatum was submitted. Cooperative tests were made using a light-weight cone for consistency of semifluid greases. A request was made for a chemical stability test for grease.

In 1943 revisions of the consistency method were considered both for grease and petrolatum. The question of consideration of various grease testing methods used by Government agencies for development as A.S.T.M. methods was brought up. A letter received from the Institute of Petroleum in England to A.S.T.M. stressed the need for cooperation in petroleum testing between the two countries. Several comments on grease testing methods were made and an effort should be made to line up our tests with theirs if possible. A test for abrasive materials in greases was requested. Several sub-subcommittees under Subcommittee IV were formed to study the effect of variables which might be present in the method for consistency (D 217). Their reports finally led to a revision of the method accepted by A.S.T.M. in June, 1944.

At that meeting, Subcommittee IV was expanded in scope to become Technical Committee G on Lubricating Greases. Its new activities will include not only the developing of test methods, but also correlation of test data with service performance and eventually the writing of specifications.

Cooperative Committees Developing Test Methods for Lubricating Greases[1]

By T. G. Roehner[2]

SPECIFICATIONS may be broadly defined as a means for facilitating description of products which will meet at least certain minimum standards of composition and performance. The practical value of those specifications is dependent on the extent to which the laboratory tests incorporated therein achieve their objectives and, it may be added, interlaboratory reproducibility of those tests is highly desirable. The development of methods suitable for adoption in specifications for lubricating greases has been stimulated by the requirements of the Armed Services. Experience with Government specifications emphasized the fact that many of the methods widely used by industry had serious shortcomings. Furthermore, it became evident that the data obtained from those tests were sometimes incorrectly interpreted. There are a number of committees that have recognized the need for improved methods for evaluating lubricating greases and through cooperative effort, important progress has been made in that direction. It may be of interest to outline briefly the activities of the following committees:

Technical Committee of the National Lubricating Grease Institute.

Annular Bearing Engineers-National Lubricating Grease Institute Cooperative Committee on Grease Test Methods.

Grease Advisory Group of Coordinating Research Council.

The objectives of the National Lubricating Grease Institute were described in considerable detail in R. R. Matthews' article entitled "The National Lubricating Grease Institute, Praeteritus, Praesens and Futura" which appeared in the June, 1944, issue of *The Institute Spokesman*. The following abstract therefrom covers their activities pertaining to test methods:

"The development of standards through research, practical tests, and other available means, the application of which, by individual manufacturers, will insure a proper measure and quality in each of the industry's products, and to collaborate with various allied technical and trade associations."

The projects studied by N.L.G.I. Technical Committee have covered a wide range. At this date it has two active projects, namely,

1. The S.O.D. pressure viscosimeter program.
2. Penetration test method and classification of block greases.

The membership of the aforementioned A.B.E.C.-N.L.G.I. Cooperative Committee is drawn from the Annular Bearing Engineers Committee of the Anti-Friction Bearing Manufacturers Association and from the Technical Committee of the National Lubricating Grease Institute. The objective of the committee is to pool the experience of grease manufacturers with the users of the greases when problems of mutual interest concerning lubrication of anti-friction bearings are involved. The committee has undertaken the following projects:

1. Determination of low temperature torque characteristics.
2. Norma-Hoffman bomb oxidation and shelf life storage tests.
3. Evaluation of high-temperature greases used at high rpm.
4. Determination of evaporation and bleeding tendencies.

Technical bulletins have been distributed through A.B.E.C. and N.L.G.I. regarding the progress made on the first three projects. Additional work is under way on all four problems.

The activities of the Grease Advisory Group of Coordinating Research Council was described in W. G. Ainsley's paper entitled "Report of the Activities of the Coordinating Research Council War Advisory Committee Grease—Advisory Group" which was presented at the October 23, 1944, meeting of the National Lubricating Grease Institute. The following is quoted therefrom:

"The membership of the Grease Advisory Group was selected by the War Advisory Committee, with consideration being given to making it a good working group, small, but including some of the leading authorities on grease problems."

Their projects originate with requests received from representatives of the Armed Services handling problems involving lubricating greases, and cover a wide range varying from recommendations regarding correct application to development of test methods. Thirty-five projects are outlined in the above paper. Of these, the projects requiring investigation and development of improved test methods are the following:

1. Low-temperature torque tests.
2. Bomb oxidation test to predict storage stability.
3. Determination of tendency to separate oil during storage.
4. Evaluation of water resistance.
5. Evaluation of high-temperature greases used at high rpm.
6. Determination of apparent viscosities at temperatures ranging from 210 F. to −90 F.
7. Determination of evaporation tendencies.
8. Determination of inorganic insoluble matter.
9. Evaluation of wheel bearing greases.
10. Evaluation of EP characteristics.
11. Procedure for taking samples.

The activities listed above for the three active committees are the basis for the statement that the manufacturers and the consumers of lubricating greases recognize the need for improved test methods.

It will be noted that certain of the above problems are being stud-

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[1] Delivered at the Organization Meeting of Technical Committee G on Lubricating Grease of Committee D-2 on Petroleum Products and Lubricants, Statler Hotel, Detroit, Mich., January 15, 1945.

[2] Manager, Technical Service Div., Socony-Vacuum Research Laboratories, Brooklyn, N. Y.

ied by more than one committee. This may be made more evident by tabulating the projects along with the interested committees:

Committee Interested[a]	
	Chemical Tests
II, III	1. Bomb oxidation tests
II, III	2. Evaporation and bleeding tendencies
III	3. Water resistance
III	4. Inorganic insoluble matter
	Physical Tests
I, II, III	1. Apparent viscosities (Pressure Viscosimeters)
I	2. Penetration of block greases
II, III	3. Low temperature torque characteristics
	Functional Tests
II, III	1. High temperature greases for ball bearings
III	2. Wheel bearing greases
III	3. Evaluation of EP characteristics
	General Interest
III	1. Sampling procedure

[a] I = N.L.G.I. Technical Committee.
II = A.B.E.C.-N.L.G.I. Cooperative Committee.
III = War Advisory Committee Grease Advisory Group.

It may be concluded from the tabulation that there is considerable unfortunate duplication of effort. Actually this has not occurred. Certain members serve on all three of the above committees, and through those members the activities on similar projects have been quite effectively coordinated. The reports issued by the committees therefore are often the net result of the pooling of experiences of more than one representative group. All three of the committees have members who also participate in A.S.T.M. activities and are familiar with scope and objectives thereof. It has been apparent that some of the test methods developed by the three committees represent material which should be further processed by A.S.T.M. in order that the fullest benefit may be realized from the effort. Therein lies one of the major opportunities for Technical Committee G to be of service.

The objectives of Technical Committee G have been outlined as follows:

1. To encourage and stimulate the interest of consumers and consumer groups in problems relating chemical, physical, and functional tests for lubricating greases to service performance.
2. Develop cooperation between existing technical groups now working on lubricating greases and Technical Committee G.
3. Examine and review existing test methods and develop new test methods where such are indicated to be desirable.
4. Evaluate and define the scope, significance, and limitations of new or existing test methods.
5. Establish relationship of data supplied by test methods to performance under well-defined service conditions.
6. Prepare and recommend material specifications.

The study of methods developed by the previously mentioned committees is therefore a logical function of Technical Committee G. Assurance may be given that as soon as Technical Committee G states that it is prepared to undertake that work, the other committees will submit reports which will constitute the basis for a number of Technical Committee G projects. For example, the A.B.E.C.-N.L.G.I. Cooperative Committee will very likely submit its report on the Norma-Hoffman Bomb Oxidation Test. Regarding the procedure for handling projects which originate from such committees, it is suggested that they be assigned to a working subgroup which would review the data obtainable from the outside committee involved and would then take those steps considered advisable to check the accuracy of the evidence. If surveys are regarded as necessary to better define the scope, significance, reproducibility, and limitations of the method, the subgroup would conduct the tests and enlist the assistance required to obtain the information needed. Its study may or may not result in modifications of apparatus and procedure from that presented in the original report. After the subgroup has completed its assignment, Technical Committee G would take the customary steps to obtain adoption as a tentative A.S.T.M. method.

In addition to projects initiated by reports from other committees interested in grease test methods, it is certain that projects will originate within Technical Committee G in accordance with objectives 3, 4, 5, and 6 given above. There is no doubt that a careful review of existing A.S.T.M. methods for lubricating greases should be undertaken. The methods now active are the following:

Tentative Method of Test for Consistency of Lubricating Greases and Petrolatum (D 217 - 44 T).

Standard Method of Test for Dropping Point of Lubricating Grease (D 566 - 42).

Standard Methods of Analysis of Grease (D 128 - 40).

It is believed that experiences with inspectors responsible for rejections and approvals of grease shipments have demonstrated that there is considerable room for improvement, particularly in the analytical methods. It may be argued that less attention should be given to chemical tests than to physical and functional tests. Composition is relatively unimportant when compared to the latter two types of evaluations. The consumer of the greases is more interested in how the products behave in service than in the percentage of soap, mineral oil, and other details of composition. It is admitted that functional tests are usually much more difficult to develop, but to meet the needs of the consumers it is suggested that Technical Committee G investigate their possibilities. The development of a test procedure to the point where interlaboratory reproducibility is assured should not be regarded as completing the problem. Interpretation of the results should be rated equally as important as design of equipment and definition of test procedure.

It is believed that important progress has been made since Pearl Harbor in developing test methods for lubricating greases. Methods have been presented for evaluating greases at temperatures ranging from −120 F. to above 350 F., at low rpm. to above 10,000 rpm., for delicate instrument bearings to bearings subjected to loads of over 100,000 psi., for applications exposed to tropic conditions to applications where long-time exposure to subzero temperatures is normal, etc. Technical Committee G has before it an unusual opportunity to make that experience available to industry in a form that can be utilized efficiently.

The Effect of Specimen Shape on the Compressive Strength Properties of Laterally Supported Plywood Specimens

By J. A. Liska[1]

Synopsis

Prism-shaped specimens have commonly been used for compression tests of wood and plywood, but hourglass-shaped specimens have been considered as possibly giving more reliable results because of improved end conditions and type of failure. This report presents the results of two series of tests performed at the Forest Products Laboratory to compare two forms of hourglass specimens (designated as types *A* and *B*) with prism-shaped specimens (designated as type *C*). In the principal series of tests, the specimens were all prepared in the normal manner with smooth ends, but the second series was designed to afford a comparison of the prism-shaped specimens (type *C*) with the hourglass specimens (type *B*) when the specimens were made with deliberately chipped and frayed ends, such as might be produced by poor fabrication.

The analysis of tests made on 200 specimens of two species and three plywood thicknesses and constructions, indicated that despite a difference in the mode of failure, the physical properties of the well-prepared prisms were in good agreement with those obtained on the two forms of hourglass specimens, and were slightly higher when small differences were noted. When the faces of the specimens were chipped and torn by improper preparation, the prism-shaped specimen (type *C*) showed a definite reduction in compressive strength as compared to well-prepared specimens of the same type and to those of the hourglass (type *B*) form. Little, if any, difference, however, in fiber stress at proportional limit or modulus of elasticity was observed between the poorly fabricated prisms and hourglass-shaped specimens (type *B*).

In the preparation of prism-type compression specimens, care should be used in fabrication to insure smooth end surfaces. When specimens are carefully prepared, the results of this study show that the prism-type specimens (type *C*) afford satisfactory test results.

Purpose

The prism-shaped laterally supported plywood compression specimens used to determine the compressive strength properties of thin plywood, as described in A.S.T.M. Tentative Methods of Testing Veneer Plywood, and Other Wood and Wood-Base Materials (D 805 - 44 T),[2] generally show a tendency to fail by buckling in the short length that must necessarily extend beyond the lateral supports. In addition, they require good fabrication to avoid chipped and frayed ends. The purpose of this investigation was, therefore, twofold: (1) to compare the strength properties of the prism form of specimen (type *C*) with those of two forms of hourglass specimens (types *A* and *B*) (Fig. 1) to determine whether or not the mode of failure was also reflected in the strength properties obtained from the different forms of specimens when all specimens were well fabricated; and (2) to compare the properties obtained from type *B* and type *C* specimens when the ends were deliberately chipped and frayed, as might be produced by poor fabrication.

Scope

The data presented show comparative results based on tests made on the three different types of specimens for each of two species and three plywood thicknesses of each species, all prepared in the normal manner with smooth end surfaces. Comparable data are also included based on tests of types *B* and *C* specimens of one plywood species and thickness, poorly sawn with the resultant frayed ends.

Description of Material

Six 24 by 24-in. plywood panels, bonded with Tego film glue (one of each of three thicknesses—0.070, 0.125, and 0.250 in.—and of each of two species—yellow birch and yellow-poplar), were made up from veneers meeting the requirements of and according to the procedures of

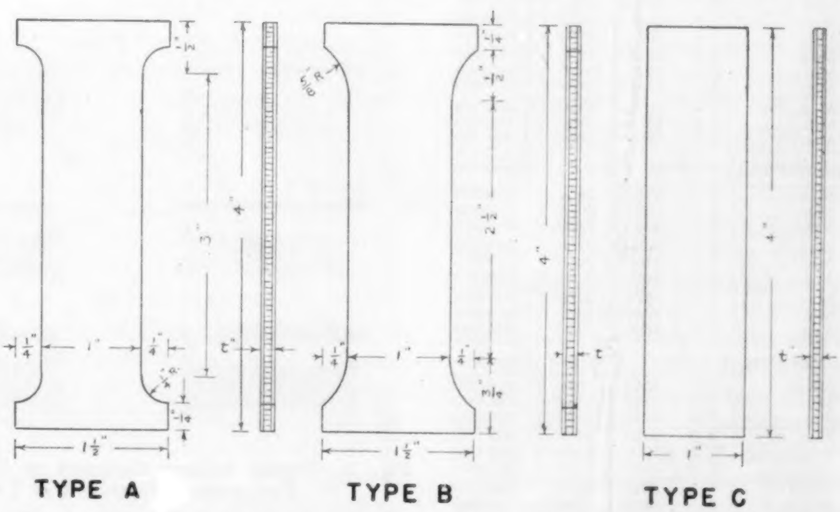

Fig. 1.—Design Details of Laterally Supported Plywood Compression Specimens.

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[1] Engineer, Forest Products Laboratory, Forest Service, U. S. Department of Agriculture, maintained at Madison, Wis., in cooperation with the University of Wisconsin.

[2] 1944 Book of A.S.T.M. Standards, Part II, p. 1453.

Army-Navy Aeronautical Specification Plywood and Veneer; Aircraft Flat Panel, AN-NN-P-511b.

Matching and Marking

Each of the six plywood panels was sawn to obtain a set of specimens of each type, ten specimens to a set. The specimens of a given set were cut out side by side across the grain of the face plies, with the grain of the face plies parallel to the length of the specimen, and the three sets were end matched. The specimens were numbered consecutively from 1 to 10, and specimens of a given species and thickness and the same specimen number were directly end matched. The hourglass specimens (types *A* and *B*) were cut to shape (Fig. 1) using a template in conjunction with a vertical-spindle woodworking shaper. In addition, two sets of specimens were prepared from the 0.125-in. birch plywood to study the effect of torn ends on the specimen properties. After preparation, all specimens were conditioned to constant weight in a room maintained at 75 F. and 64 per cent relative humidity.

TABLE I.—COMPARATIVE STRENGTH PROPERTIES OF PRISM-SHAPED (TYPE *C*) AND HOURGLASS (TYPES *A* AND *B*) LATERALLY SUPPORTED PLYWOOD COMPRESSION SPECIMENS.

Specimen Type	Moisture Content, per cent	Maximum Crushing Strength, psi.	Fiber Stress at Proportional Limit, psi.	Modulus of Elasticity, psi.
Yellow Birch 0.070-in. Three-Ply Plywood				
A Max.	8.1	6080	4820	1 440 000
Min.	7.6	5550	3720	1 310 000
Avg.	7.8	5820	4190	1 360 000
B Max.	8.6	6010	4780	1 360 000
Min.	7.7	5560	3640	1 240 000
Avg.	8.2	5860	4030	1 310 000
C Max.	8.5	6390	4040	1 540 000
Min.	7.8	5630	3460	1 190 000
Avg.	8.2	6070	3790	1 400 000
Yellow Birch 0.125-in. Three-Ply Plywood				
A Max.	8.7	6130	3930	1 390 000
Min.	8.2	5560	3340	1 270 000
Avg.	8.5	5880	3630	1 320 000
B Max.	8.6	5920	4660	1 460 000
Min.	8.2	5480	3200	1 270 000
Avg.	8.4	5690	3770	1 340 000
C Max.	8.4	6590	4700	1 400 000
Min.	7.8	5960	3710	1 310 000
Avg.	8.0	6210	4110	1 360 000
Yellow Birch 0.250-in. Five-Ply Plywood				
A Max.	8.6	5620	3460	1 250 000
Min.	8.3	5190	2900	1 100 000
Avg.	8.4	5370	3190	1 180 000
B Max.	8.9	5580	3360	1 300 000
Min.	8.1	5270	2740	1 180 000
Avg.	8.5	5430	3080	1 230 000
C Max.	8.2	5560	3720	1 330 000
Min.	7.8	5300	2900	1 170 000
Avg.	8.0	5440	3370	1 260 000
Yellow-Poplar 0.070-in. Three-Ply Plywood				
A Max.	7.7	5020	4180	1 320 000
Min.	5.9	4460	3050	1 110 000
Avg.	7.1	4700	3680	1 200 000
B Max.	8.3	5340	4490	1 310 000
Min.	7.8	4520	3660	1 020 000
Avg.	8.1	4980	3970	1 170 000
C Max.	8.8	5220	4350	1 330 000
Min.	7.3	4530	3380	1 190 000
Avg.	7.6	4900	3840	1 260 000
Yellow-Poplar 0.125-in. Three-Ply Plywood				
A Max.	8.3	3780	2450	910 000
Min.	7.2	3250	2090	740 000
Avg.	7.9	3440	2220	800 000
B Max.	8.2	3950	2700	995 000
Min.	7.8	3160	2080	730 000
Avg.	8.0	3470	2300	840 000
C Max.	7.7	3870	2770	965 000
Min.	7.4	3340	1890	810 000
Avg.	7.6	3590	2280	880 000
Yellow-Poplar 0.250-in. Five-Ply Plywood				
A Max.	7.7	3540	2880	910 000
Min.	7.3	3110	1850	755 000
Avg.	7.6	3240	2120	825 000
B Max.	7.9	3520	2570	915 000
Min.	7.5	2900	1840	705 000
Avg.	7.8	3190	2050	810 000
C Max.	7.6	3640	2570	950 000
Min.	6.9	2870	1850	760 000
Avg.	7.2	3260	2190	855 000

TABLE II.—COMPARATIVE COMPRESSIVE STRENGTH PROPERTIES OF POORLY FABRICATED, PRISM-SHAPED SPECIMENS AND HOURGLASS-SHAPED SPECIMENS LATERALLY SUPPORTED. SPECIMENS WERE 1/8-IN. YELLOW BIRCH PLYWOOD.

Specimen Type	Moisture Content, per cent	Maximum Crushing Strength, psi.	Fiber Stress at Proportional Limit, psi.	Modulus of Elasticity, psi.
B Max.	9.3	5840	4570	1 410 000
Min.	8.6	5380	3660	1 160 000
Avg.	9.0	5620	4030	1 280 000
C Max.	8.7	5360	4510	1 350 000
Min.	8.3	4890	3490	1 180 000
Avg.	8.6	5180	4060	1 280 000

Method of Test

The individual specimens were weighed and measured and then tested in accordance with the procedure outlined in A.S.T.M. Methods D 805 for compression tests on material $\frac{3}{4}$ in. in thickness. The tests were conducted in a room in which the temperature and humidity were controlled to 75 F. and 64 per cent relative humidity, respectively. The type of failure for each type of specimen was noted, and the complete specimen was then used for a determination of moisture content.

Presentation of Data

The summation of comparative strength properties of the various specimen types for all plywood thicknesses of both species is pre-

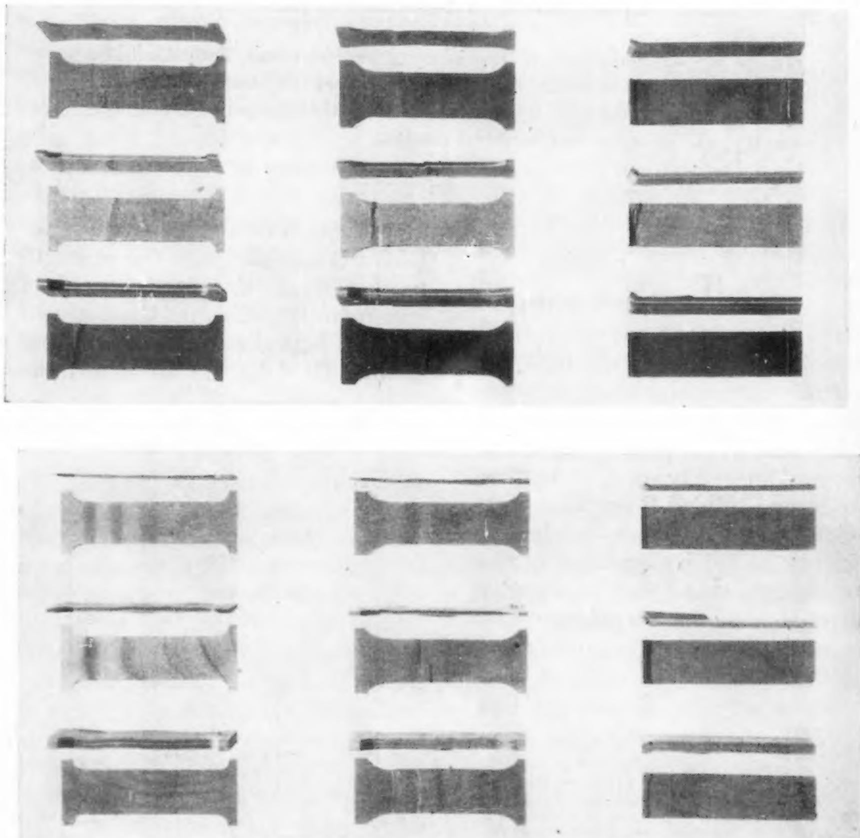

Fig. 2.—Typical Failures Obtained on Three Types of Laterally Supported Plywood Compression Specimens of Two Species and Three Thicknesses.

Type *A*, left; type *B*, center; and type *C*, right.

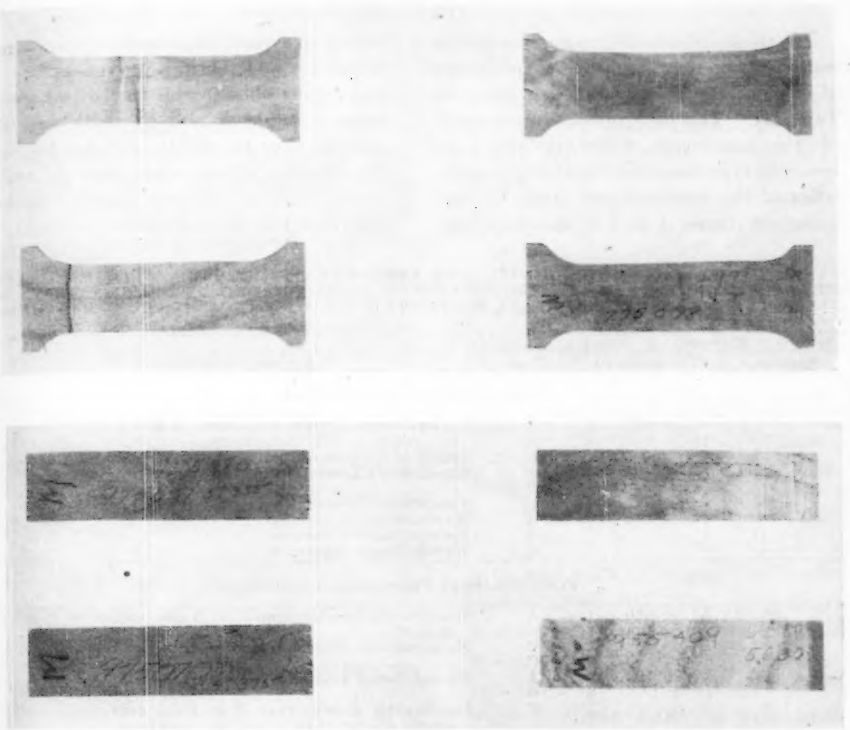

Fig. 3.—Example of Good and Bad Methods of Specimen Preparation, Showing the Chipped and Frayed Ends Which Result on Type *B* (top, left) and Type *C* (bottom, left) Specimens When Insufficient Care Is Taken in Their Fabrication.

sented in Table I. Included therein are the moisture content values for the test specimens, which afford an indication of the uniformity of the conditioning treatment and permit proper evaluation of the strength results, since each of these varies with moisture content. The strength properties at ultimate and proportional limit and the modulus of elasticity values for each specimen group are tabulated.

Specific gravity values based on volume at test and weight when oven-dry indicated that the plywood of a given thickness was fairly uniform in density. The birch plywood averaged 0.68, 0.68, and 0.65 and the yellow poplar plywood 0.54, 0.46, and 0.43 for the 0.070-, 0.125-, and 0.250-in. plywood thicknesses, respectively.

Table II presents a similar tabulation of data for the supplementary test series to show the effect of frayed ends on test results.

Typical specimens are shown in Figs. 2 and 3. Figure 2 shows typical failures for each of the specimen types, and Fig. 3 permits a visual comparison of good and bad end conditions.

Analysis of Results

Since the material was conditioned and tested in a room in which the temperature and humidity were controlled, the moisture content variation within a species thickness group was, in general, small; and, since an adjustment of strength values for moisture content differences of $\frac{1}{2}$ per cent or less is not justified, the actual test results may be compared without material error.

The variation of the values of average ultimate compressive strength and modulus of elasticity within each species thickness group was, in most instances, 5 per cent or less, and the maximum variation was 9 per cent. Although the proportional limit values are normally more variable and a somewhat greater spread in results was anticipated, the maximum variation was 12 per cent, and it was generally closer to half of that value. In the majority of tests, the prism-shaped specimens gave the highest average results for both compressive strength and modulus of elasticity, although, as previously mentioned, the differences were not large. It is believed that the modulus of elasticity values were less for the hourglass specimens because of the restraining action of the added material. In the use of such specimens, it appears necessary to use a somewhat longer specimen or shorter gage length compressometer to eliminate this effect.

The close agreement of results was obtained despite marked differences in type of failure, as shown in Fig. 2. The prism-shaped specimen (type *C*) in the 0.070- and 0.125-in. plywood thicknesses failed more than 90 per cent of the time by buckling in the short length of specimen above the lateral supports. In the 0.250-in. plywood, this type of failure occurred in approximately half of the cases. The failures in the hourglass specimens (types *A* and *B*) were, in practically all instances, normal compression failures (shear type) occurring in the net section of the specimen.

The data presented in Table II provide an indication of results obtained from improperly prepared specimens having chipped and torn ends. These data are based on tests of 0.125-in. yellow birch plywood and may be compared with the results secured on well-prepared specimens given in Table I. Both specimen types in this series show only slight changes for values of fiber stress at proportional limit and modulus of elasticity as compared with the values in Table I. The prism-shaped specimen (type *C*), however, shows a 10 per cent decrease in ultimate compressive strength; whereas this decrease is only slight for the type-*B* specimens. It is apparent, therefore, that specimens must be properly prepared to secure good test results. Since the type *C* specimen is much easier to prepare, it is the most simple to use for this type of test, provided that proper consideration is given to secure satisfactory specimens.

Although the differences in mean values obtained for the various physical properties from each of the specimen types within a species-thickness group were usually small, it was decided to determine whether or not these differences were significant. Therefore, a statistical analysis was made on the data to obtain results on significant differences between specimen-type means for each property in each species-thickness

group, and a summary of this analysis is included in Table III of the Appendix. In general, the analysis indicated that the mean compressive stress obtained on type C specimens was significantly greater than that obtained on specimens of either type A, type B, or both at the 1 per cent level for the 0.070- and 0.125-in. plywood of both species. Likewise, the mean values of the modulus of elasticity for type C were significantly greater than those for the other two types. More variation was encountered in the analysis of the values of proportional limit stress because of the personal equation involved in their evaluation. It was apparent, however, that when the specimen ends were frayed, the maximum crushing strength for the type B specimens was significantly greater than that for specimens of type C.

Conclusions

Although the characteristic mode of failure of the prism-shaped specimen (type C) differed from that of the hourglass specimens (types A and B), the results of this program indicated that these three types of laterally supported plywood compression specimens give essentially the same results, with the prism-shaped specimens (type C) giving the slightly higher values. This assumes that the specimens are carefully prepared so that their ends are smooth, parallel to each other, and perpendicular to their lengths.

If the specimens have poorly cut ends and the plywood faces are torn, the prism-shaped specimen (type C) will give markedly lower ultimate compressive strength values. The hourglass specimens (type B) are more satisfactory if this condition exists.

When specimens are carefully prepared, the prism-shaped specimens (type C) afford satisfactory test results, and because of its shape, it is the most simple one to use for this type of test. In its preparation proper care should be exercised to insure smooth end surfaces.

Appendix

The results of a statistical analysis of the test results on the three types of specimens of each of the two species are given in Table III. This table presents a summary of the significant differences between specimen type means for the strength properties of the prism-shaped (type C) and hourglass (types A and B) laterally supported plywood compression specimens. It also gives significant differences for the test results obtained on frayed end specimens of types B and C. Although the analysis may be slightly clouded because the selection of specimens was not truly randomized, it is believed that the conclusions based on the analysis are pertinent.

TABLE III.—SUMMARY OF SIGNIFICANT DIFFERENCES BETWEEN SPECIMEN TYPE MEANS FOR THE STRENGTH PROPERTIES OF PRISM-SHAPED (TYPE C) AND HOURGLASS (TYPES A AND B) LATERALLY SUPPORTED PLYWOOD COMPRESSION SPECIMENS.

Plywood		Specimen	
Species	Thickness, in.	Type	Significant Difference
Maximum Compressive Stress			
	0.070	A	No significant difference between A and B
		B	....
		C	Significantly greater than A and B at 1 per cent level
Yellow birch....	0.125	A	Significantly greater than B at 5 per cent level
		B	....
		C	Significantly greater than A and B at 1 per cent level
	0.250	A	No significant difference
		B	No significant difference
		C	No significant difference
Fiber Stress at Proportional Limit			
	0.070	A	Significantly greater than C at 5 per cent level (but not than B)
		B	No significant difference between B and C
		C	....
Yellow birch....	0.125	A	No significant difference between A and B
		B	....
		C	Significantly greater than B at 5 per cent level—significantly greater than A at 1 per cent level
	0.250	A	No significant difference between A and B
		B	....
		C	Significantly greater than B at 5 per cent level (but not than A)
Modulus of Elasticity			
	0.070	A	No significant difference between A and B
		B	....
		C	Significantly greater than B at 1 per cent level (but not than A)
Yellow birch....	0.125	A	No significant difference
		B	No significant difference
		C	No significant difference
	0.250	A	....
		B	No significant difference between B and C
		C	C and B are significantly greater than A at 1 per cent level
Maximum Compressive Stress			
	0.070	A	....
		B	No significant difference between B and C
		C	C and B are significantly greater than A at 1 per cent level
Yellow-poplar...	0.125	A	No significant difference between A and B
		B	....
		C	Significantly greater than A at 5 per cent level (but not than B)
	0.250	A	No significant difference
		B	No significant difference
		C	No significant difference
Fiber Stress at Proportional Limit			
	0.070	A	No significant difference between A and C
		B	Significantly greater than A at 5 per cent level (but not than C)
		C	....
Yellow-poplar-..	0.125	A	No significant difference
		B	No significant difference
		C	No significant difference
	0.250	A	No significant difference
		B	No significant difference
		C	No significant difference
Modulus of Elasticity			
	0.070	A	No significant difference between A and B
		B	....
		C	Significantly greater than A at 5 per cent level—significantly greater than B at 1 per cent level
Yellow-poplar...	0.125	A	No significant difference between A and B
		B	....
		C	Significantly greater than B at 5 per cent level—significantly greater than A at 1 per cent level
	0.250	A	No significant difference between A and B
		B	....
		C	Significantly greater than A at 5 per cent level—significantly greater than B at 1 per cent level
Frayed-End Specimens			
	0.125	B	Significantly greater than C at 1 per cent level (maximum compressive stress)
Yellow birch....	0.125	B	No significant difference between B and C (fiber stress at proportional limit)
	0.125	B	No significant difference between B and C (modulus of elasticity)

New A.S.T.M. Publications

Steel Piping, Copper and Copper Alloys, Paper Products, Textile Fibers, X-ray Diffraction, Electrical Contacts

Although the heaviest publication load has been lifted with the appearance of the 1944 Book of A.S.T.M. Standards, there is still a very extensive schedule of publications confronting the Society. Part III, Nonmetallic Materials—General, of the Book of Standards was the last to come from the bindery, and distribution is now virtually complete, although the Book may not reach some of the more distant members until the middle of April. Part II on Nonmetallic Materials—Constructional was mailed in February and Part I on Metals, early in March.

Other books have been issued, including three special compilations of standards of widespread interest in specific fields. Brief notes on these follow.

Steel Piping Materials:

This 346-page book gives all of the specifications issued by the Society through the work of its Committee A-1 on Steel covering pipe, tubes, castings, forgings, bolts and nuts, welding fittings, etc., and in addition includes the Classification of Austenite Grain Size in Steels, E 19, Specifications for Welded Wrought Iron Pipe, (A 72) and the American Standard B 36.10, giving dimensional standards. All emergency alternate provisions applying to the steel piping specifications are included. With many important changes in the specifications, this up-to-date compilation should be of particular service to the industries concerned. Price: to A.S.T.M. members, $1.35; List, $2.00.

Paper and Paper Products:

Comprising the bulk of this 192-page book are 49 standards issued for the most part through the work of Committee D-6 and providing in their latest form a large number of test methods and the seven specifications developed in this field. The tests cover quite a variety of products—for example, gummed tape (adhesiveness), mineral coating on coated paper, paraffin content of waxed paper, etc.; but most of these tests are applicable to papers in general—for example, moisture, opacity, bursting strength, machine direction, etc. Price: to A.S.T.M. members, $1.00; List, $1.50.

Copper and Copper Alloys:

This compilation provides some 90 specifications and tests covering a wide variety of copper and copper alloy products in the form of wire, sheet, rods, pipe, castings, etc. It gives not only all the standards developed through the work of Committee B-5, but many of those issued through the work of Committee B-1 on Copper and Copper-Alloy Wires for Electrical Conductors, and selected specifications from Committee B-2 on Non-Ferrous Metals and Alloys. This is the third edition of this book. It has been particularly helpful in connection with the very heavy production of numerous products essential in the war effort. The book is available in paper and cloth binding, members prices being $1.80 and $2.00. List, $2.75 and $3.00.

Supplement to Bibliography on Electrical Contacts:

This supplement brings up to date the very valuable publication issued early last year giving bibliographies relating to electrical contacts, from 1835 to 1943. Issued under the auspices of Committee B-4 through a special subcommittee, headed by E. I. Shobert, with Messrs. George Durst, S. G. Eskin, and F. R. Hensel serving on the committee, the original book and the supplement comprise a monumental contribution in this field. The supplement follows the style of the original—each item giving the author and the source publication, and, of particular value, abstracts of most of the articles. The supplement, in addition to bringing the material up through 1944, also gives numerous additional references for the earlier periods. The supplement, as well as the original, gives a complete author index, and a key to abbreviations. A subject index is helpful in locating material on specific subjects, contact materials, circuit breaker design and tests, etc. Price to A.S.T.M. members, $1.50; List, $2.00.

Edgar Marburg Lecture:

The Edgar Marburg Lecture on "Textile Fibers—An Engineering Approach to an Understanding of Their Properties and Utilization," by Dr. H. DeWitt Smith, is to be printed soon. Since the presentation of the lecture, Dr. Smith has spent considerable time perfecting his manuscript, has included important material to round out his treatment of the subject and has added a large number of tables and illustrations. Separate copies should be available within a few weeks, and here again, due notice will be given members who may wish to secure copies in separate booklet form. This lecture will, of course, be included in the 1944 *Proceedings*.

X-ray Diffraction Data:

A relatively new development is a supplementary set of X-ray diffraction data cards, totaling over 4300 new cards as compared with the original file of around 4000 cards. This new material gives important data on X-ray diffraction patterns of some 1500 minerals and compounds not referred to in the original set.

Work on these cards is carried out through a joint committee of which the Society is one of the sponsors. Information covered in the supplementary material was made available by extensive research by the British Institute of Physics which cooperated in joint committee activities. Preparation of the master cards was handled by Prof. W. P. Davey and associates at Pennsylvania State College. The collating work has been done at A.S.T.M. Headquarters.

The committee in sponsoring the development and publication of this material is rendering notable service to this relatively new but important and growing field. In connection with further developments involving publication of supplementary material, the National Bureau of Standards is planning to cooperate with its personnel aiding in the development of X-ray diffraction data.

This set of over 4300 supplementary cards will be available sometime in April and will sell for $75 per set, which includes shipment in suitable box files, and a new index.

ASTM Bulletin

MARCH 1945

NO. 133

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SOUTH BROAD ST.
PHILADELPHIA 2, PENNA.

Publication Changes

New Plans of Interest to All Members

One of the involved matters which the special Study Committee, investigating almost all phases of A.S.T.M. work and its method of operating has been considering concerns the Society's publications, including the method of publishing standards and committee reports and in particular the publication of technical papers. Decisions on the latter which will affect the annual *Proceedings* and the Bulletin are aimed to bring more promptly to the members many of the technical papers. In essence, the new plan will encourage the offering of papers at any time throughout the year, preprinting of these papers as soon as possible, and subsequent distribution to the members by a request form to be published in the ASTM Bulletin together with a synopsis of the particular items that would be available.

The scheme that has been in effect has concentrated preprinting of papers immediately prior to the Annual Meeting and the distribution in two or three installments at this time. Since some authors whose papers were scheduled for the meeting found it impossible to get manuscripts prepared in time for preprinting, this meant that some items would not be available until the *Proceedings* were issued many months later. (This year, for example, the *Proceedings* now in preparation with distribution scheduled for some time in late April, will include a number of items of rather widespread interest which were not preprinted.) There will continue to be published in the Bulletin and also in the bound volume of *Proceedings* which will be issued later, those papers and discussions of wide general interest. At the same time the Bulletin will also continue to include technical papers, articles, and reports, and related items that are of current technical or educational value, but which do not warrant inclusion in a bound volume of *Proceedings*. Perhaps the best way to convey a sense of this change is to refer to the material given on page 39 comprising synopses of four extensive technical papers judged suitable and desirable for inclusion in *Proceedings* and of a nature that would not fit in with the concept of the material for the Bulletin. These four items will be preprinted within the next few weeks and distributed to those members who return the coupon shown. Type for these papers will be held and when the 1945 volume comprising *Proceedings* and selected technical papers is issued, they will be included.

It should be emphasized that every paper published in the Bulletin will be evaluated for inclusion in the *Proceedings*.

Bulletin Style and Format:

In order that Bulletin papers may be more easily remade up in the smaller *Proceedings* page size, the material in the Bulletin is to appear henceforth in triple-column format with a style of type that will quite closely match that used in *Proceedings*. This triple-column style has some other distinct advantages, and although the size of type is maintained the same as for previous Bulletins, eventually a reduction may be made with a similar change in the *Proceedings*.

With this modification, other minor changes in style and format are being incorporated. Efforts will be made to segregate material of a related nature in the Bulletin. For example, notes on publications, on District activities, on technical committee work, etc., will, where possible, appear together.

Studies are under way on the establishment of a monthly technical journal, but certainly for many months there will be no action on this particular matter.

A Bit of History

The first Bulletin, No. 1, issued on April 1, 1921, 24 years ago, was intended to provide a convenient means of communication with the members and keep them informed of Society activities, particularly the work of technical committees. About 1933 the scope was extended and papers of a quasi-technical nature and related matters were included. In 1936 the Committee on Papers and Publications extended the scope still further to include papers of a nontechnical nature but on matters within the A.S.T.M. field, papers covering exploratory research, new applications of test methods, and papers submitted by committees which wished to have more prompt distribution than the annual *Proceedings* would afford. For the past few years each issue of the Bulletin has carried several technical papers on subjects of distinct interest to a broad section of the membership. On one or two occasions material was of such wide interest and importance to the war effort, it was published in the Bulletin in order to secure more prompt dissemination of the material, although under normal conditions the *Proceedings* would have been selected.

The new scheme does not contemplate drastic changes in the Bulletin scope and, if anything, there will be an expansion of the technical content. The Bulletin will continue to be a *members* publication designed to be of as much service as possible to them.

An Active A.S.T.M.—despite cancelled meetings

To a large percentage of the membership of the Society, the announcement of the cancellation of the Spring Meeting has undoubtedly come as a keen disappointment. While a general session with a discussion of some subject of timely interest marks these meetings, the outstanding and the most productive feature is the series of committee meetings which takes place. The output of specifications and of standard methods depends upon committee activities. These for their proper functioning demand assemblies where through open forums the proposals of the smaller preparing groups can be discussed by the full membership. When through circumstances which now prevail, such meetings must be set aside, the committees of necessity find themselves in quite a quandary. What to do and how to do it becomes a matter of pronounced concern.

The smaller committees can continue to operate as heretofore as long as less than 50 individuals require intercity travel or hotel accommodations. The larger committees according to the present ODT request must for the time being forego meetings or carry on with meetings restricted in attendance—if their by-laws permit any restrictions.

In any and all cases, it is hoped that committee officers will not assume that since meetings must be postponed all their activities should follow suit. The mails are still more than fairly expeditious and efficient. Much can be accomplished in this manner in originating work, seeing that it is carried through and in discussing the results. Also such efforts can be delegated to small groups which can hold meetings if they feel they are justified. Clearly effective work can continue up to the point of amending and accepting standards—and in many cases this can also be accomplished.

The provisions given in Paragraph (*b*), Section 14 of the Regulations Governing Standing Committees should also be borne in mind. By these it is clear "that at the direction of the chairman of standing committees" recommendations affecting standards approved by letter ballot of a subcommittee may be referred directly to letter ballot vote of the standing committee without authorization at a meeting of the latter. Standards may therefore be prepared and adopted by a committee without holding a meeting. It is acknowledged that generally such procedure is not to be commended very highly, as it precludes the open discussion in meetings, which are so valuable and in general essential. However, we are in an emergency and while the "duration" lasts we are carrying out many not too fortunate but also not too ineffective measures.

The present possible uncertainty regarding holding a June meeting of the usual type should not in any manner be taken as a reason for "easing off" in Society work. Much can happen between now and mid-June—and we do hope much of a favorable nature will take place in Europe. A June meeting of the usual type may be held. In any event a meeting then of some kind can hardly be avoided. So let us all keep going on in A.S.T.M. activities as usual, feeling determinedly that since a job is to be done, it will be done even under most unfavorable circumstances.

P. H. Bates

President

DISTRIBUTION OF PREPRINTS

(SEE COUPON ON REVERSE SIDE)

The Effect of Iron Content of Cupro-Nickel on Its Corrosion Resistance in "Sea Water." A. W. Tracy and R. L. Hungerford.

Data are given on a laboratory investigation concerning the effect of iron additions to cupro-nickels on the corrosion resistance of the alloys exposed to "sea water" in motion. The "sea water" was a 3 per cent solution of sea salt. Sheet metal specimens were tested by attaching to fiber disks which were rotated in the test solution and tube specimens were placed in an experimental condenser.

The extent of corrosion is determined on sheet metal specimens by measuring losses in thickness by means of sharp-pointed micrometers. Corrosion of tube specimens is judged from visual examinations.

The tests show quite conclusively the effect of iron content in improving the corrosion resistance of cupro-nickels in sea water and indicate that as the nickel content of the alloy is decreased, increasing amounts of iron are required for optimum corrosion resistance.

Properties of Highly Hydrated Dolomitic Masonry Limes and Certain of Their Cement-Lime Mortars. G. J. Fink and Emil Trattner.

Presents the results of tests of the six commercially available masonry limes of a new type, the highly hydrated dolomitic limes. Data are presented on the chemical and physical properties of the limes, on the physical properties of mixtures in the proportion of 1 bag of portland cement to 2 bags of lime tested as masonry cements, and on 1:2:9 mortars prepared from the limes. In order to simulate more nearly the conditions of job use, additional 1:2:9 mortars were also tested 30 min. after the initial mixing and after the mortars had been subjected to suction for 1 min. All the limes contained small percentages of unhydrated oxides and showed low expansions in the autoclave; all had high plasticities and high water retentivities. All the mortars made with these limes exhibited good workability and unusually high water retentivity.

Fracture Testing of Alloy Steels for Aircraft Engine Forgings. R. D. Haworth, Jr., and A. F. Christian.

An unusual condition of alloy steel forgings, shown by fracture examination and termed "grain coarsening," has attracted considerable interest in recent years among the manufacturers of highly stressed aircraft engine parts. While a small amount of grain coarsening has no harmful effect on physical properties, a larger amount decreases toughness, and hence the condition should be eliminated from aircraft engine members as far as possible.

The appearance of large grains or "facets" on the fractured surface of fully heat treated forgings was generally considered indicative of overheating during the forging operation. However, it has been clearly demonstrated that this condition can be produced in certain heats of steel at normal forging temperatures. Other factors equally as influential as heat sensitivity are (1) the time at temperature and (2) the amount of reduction during the forging operation.

Photographs of fractures after various heat treatments are shown and a complete set of fracture test standards are presented. Operation of the test in production is described as well as the results which have already been achieved. A study of the present state of knowledge concerning the cause and mechanism of grain coarsening is also submitted.

The Testing of Portland Cements Containing Interground Vinsol Resin. R. L. Blaine, J. C. Yates, and J. R. Dwyer, National Bureau of Standards.

Tests were made on 64 commercially manufactured air-entraining portland cements containing interground Vinsol resin to obtain information on methods of testing. Data are presented in tables and figures on the fineness and water requirements of the cements, the amount of air entrained in various pastes, mortars, and concrete, and the tensile and compressive strengths of test mortar specimens at 3, 7, and 28 days. The tests reported furnish information relating to some of the recent changes in methods of test and specification requirements of air-entraining cements.

Annual Meeting

MEMBERS of the Society and others are much interested in having definite information concerning the status of the Annual Meeting which is scheduled to be held in Buffalo, June 18 to 22. In conjunction with this meeting, it is planned to hold the Society's Seventh Exhibit of Testing Apparatus and Related Equipment, and many applications for exhibit space have been received—in fact, the largest number at this date for any exhibit.

The Executive Committee has made no change in its plans to proceed with the meeting, although as this BULLETIN nears press, discussions are under way with the Washington Committee on Conventions and the Office of Defense Transportation to determine just what policy may be in the best interests of all concerned.

If it is decided not to proceed with the plans for the Annual Meeting in Buffalo, one of two alternatives might be followed. One would be the combination of a business meeting in some industrial center convenient and accessible to a number of our members at which the business of the Society could be transacted for reference to letter ballot, plus a number of local meetings primarily for presentation and discussion of papers. The other would be to postpone the entire meeting until the Fall, when travel conditions might be such as to permit the regular type of meeting.

Once a final decision has been reached, detailed information will be furnished to the members as soon as possible.

Nominations for Officers

THE Nominating Committee to select nominees for Society officers met in Philadelphia on March 1. The personnel of this group was listed in the December, 1944, ASTM BULLETIN. In accordance with the provisions of the By-laws of the Society the following nominations are announced:

For President:

J. R. Townsend, Materials Engineer, Bell Telephone Laboratories Inc., New York, N. Y.

For Vice-President:

T. A. Boyd, Head, Fuel Department, Research Laboratories Division, General Motors Corp., Detroit, Mich.

For Members of Executive Committee:

J. R. Freeman, Jr., Technical Manager, The American Brass Co., Waterbury, Conn.

L. J. Markwardt, Assistant Director, U. S. Forest Products Laboratory, Madison 5, Wis.

C. H. Rose, Chemist, National Lead Co., Brooklyn, N. Y.

L. P. Spalding, Chief Research Engineer, North American Aviation, Inc., Inglewood, Calif.

W. A. Zinzow, Chief Physicist, Bakelite Corp., Bloomfield, N. J.

Each of the above nominees has indicated in writing his acceptance of his nomination. The By-laws provide that "further nominations, signed by at least 25 members, may be submitted to the Secretary-Treasurer in writing by May 25, and a nomination so made, if accepted by the member nominated, shall be placed on the official ballot" which "shall be issued to members between May 25 and June 1."

In the May BULLETIN be on the lookout, if interested, for articles and news on the following:

1. Ordnance Advisory Committee.
2. Details of Parts and Assembly Testing.
3. District Committee Administrative Group.
4. New "Testing Apparatus" Paper Award.
5. New Committee on Quality Control.
6. Important Announcements on the Annual Meeting Situation.

Request Blank for

Advance Distribution of 1945 Preprints of Papers

NOTE.—The four papers listed below have been preprinted for immediate distribution in accordance with the new policy of the Society of preprinting papers as they become available throughout the year. Abstracts of these papers appear on the reverse side of this blank.

Please Indicate Preprints Desired, Fill in Address, and Return Promptly

PREPRINTS WILL BE SENT ONLY TO MEMBERS IN GOOD STANDING

Check Item Desired		
———	A 1	Properties of Highly Hydrated Dolomitic Masonry Limes and Certain of Their Cement-Lime Mortars—G. J. Fink and Emil Trattner.
———	A 2	The Effect of Iron Content of Cupro-Nickel on Its Corrosion Resistance in "Sea Water"—A. W. Tracy and R. L. Hungerford.
———	A 3	The Testing of Portland Cements Containing Interground Vinsol Resin—R. L. Blaine, J. C. Yates, and J. R. Dwyer.
———	A 4	Fracture Testing of Alloy Steels for Aircraft Engine Forgings—R. D. Haworth, Jr., and A. F. Christian.

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Steady Growth in Membership

From the accompanying diagram, it will be seen that during 1944 the Society experienced a steady, if not spectacular, growth in membership. The total number of new members, 567, by an odd coincidence was exactly the same as for 1943, but the net increase, 355, was the greatest in the Society's history, being 22 ahead of the previous year, because of fewer deaths, resignations, and other losses. These figures were noted to the Executive Committee in the Secretary-Treasurer's Report on Membership for 1944. It is of interest to note the total number of members at the peak, 5381, and to compare this figure with the one of some 14 years ago, 4417, which was reached during the depression period.

Of the total membership, 191 are Sustaining Members, 1368 company, group, and association members, 3666 individuals and others, and 138 Juniors; also 9 honorary members and 9 memberships in perpetuity. Student membership totaled 450. The total net increase of 7.1 per cent was the same as the previous year. While one may adopt various degrees of optimism concerning this figure, it is felt generally the increase is reassuring and a healthy one.

With the Society's activities extending into relatively new fields, a number of the new members joined because they want to follow the Society's standardization work and research in these particular industries. Always, there are many companies and individuals who may have known about the Society's standards, but who have not known of some of the advantages of membership; and the efforts of our individual members and district and technical committees result in substantial numbers of new members.

It has been stated many times that as membership increases, not only does the Society benefit in tangible ways, but also there is the ever-widening prestige through the more effective use of recognized specifications and tests, and the broader dissemination of the benefits from research data developed. Consequently the Executive Committee is most anxious that the very loyal support received from our members shall continue, because basically it is the enthusiasm of the group which results in our continuing growth. The year 1945 is an excellent one for both companies and individuals to become members because of the new Book of A.S.T.M. Standards just completed.

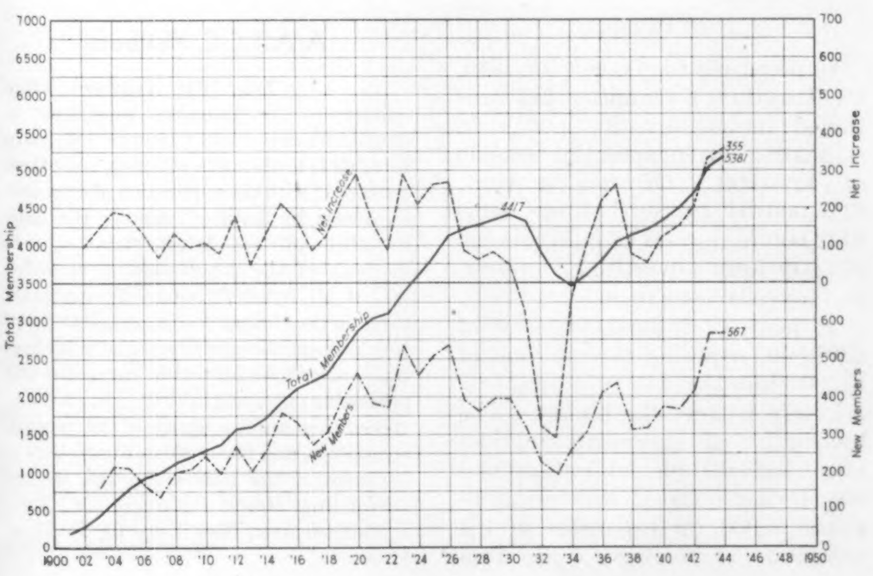
Sustaining Membership.—As a class, Sustaining Membership showed by percentage the largest growth of any of the groups with 26 organizations having joined, representing an increase of 15 per cent, bringing the total to 191. For organizations vitally concerned with the field of materials and who can make use of a complete set of all of the Society's publications, including extra copies of the Book of Standards and the ASTM Bulletin, this class of membership has considerable merit, and at the same time it affords the company an opportunity to support A.S.T.M. activities to a degree somewhat more commensurate with advantages received, through payment of annual dues of $100. A complete list of Sustaining Members as of August, 1944, appears on page 15 of the 1944 Year Book. A list of new sustaining members for 1944 follows.

American Bosch Corp.
Boeing Aircraft Co.
Bridgeport Brass Co.
Casein Company of America, Division of The Borden Co.
Celanese Corporation of America, Plastics Division
Central Scientific Co.
Cessna Aircraft Co.
Consolidated Mining and Smelting Co. of Canada, Ltd., The
Continental-Diamond Fibre Co.
Fulton Sylphon Co., The
Greiner Co., The Emil
Humble Oil and Refining Co., Petroleum Engineering Dept.
Industrial Synthetics Corp.
International Business Machines Corp.
Johnson and Nephew, Ltd., Richard
Kennecott Wire and Cable Co.
Merry Brothers Brick and Tile Co.
National Electric Products Corp.
National Vulcanized Fibre Co.
Permanente Cement Co.
Pittsburgh Plate Glass Co.
Precision Castings Co., Inc.
Precision Scientific Co.
Sharples Chemicals, Inc.
Sheffield Steel Corp.
Weyerhaeuser Timber Co.

The organizations which have become sustaining members as of January, 1945, are as follows:

Kendall Refining Co.
California Portland Cement Co.
Congoleum-Nairn, Inc.

A.S.T.M. Headquarters will be glad to send information on membership and details of sustaining membership to any organizations or individuals.



Vol. I Proceedings Wanted

A member of the Society is very anxious to procure Vol. I of the *Proceedings* covering the years 1899–1902. This volume has not been available from Headquarters for many years, but some member might have one in his files and would be willing to sell it. Communications should be addressed to A.S.T.M. Headquarters.

Financial Highlights—1944

WHILE a detailed report of the financial operations of the Society during 1944 will be included as customary in the 1945 Annual Report of the Executive Committee, there are some interesting highlights which are excerpted below from the report submitted by the Secretary-Treasurer to the Executive Committee at its January meeting. It has been the practice to note some of these items in the March BULLETIN each year. On an adjoining page are some data on Society membership, which influences the financial picture because of the entrance fees and dues involved.

1944 Operating Receipts:

This year receipts were at an all-time high of $265,547, exceeding the previous year by approximately $3000. Of this amount $121,373 (45.7 per cent) came from dues and entrance fees, and $121,044 (45.6 per cent) from sales of publications. Receipts from all other sources were $23,130, of which $14,491 was from advertising and $5477 from interest and dividends. The income from sales of special compilations of standards, symposiums, reprints, etc., was over $51,000, about $9000 higher than any previous year. This indicates the very gratifying widespread distribution of these special publications.

1944 Operating Disbursements:

Because of greatly increased printing expenses, also increased costs of expanding operations, increases in the Staff, and extensions in the Employee's Retirement System, the operating disbursements were $249,948, by far the highest ever. Of the publication expenses, over $19,000 went for the *Proceedings*, preprints took another $4350; the $30,000 disbursement for the new 1944 Book of Standards was only part of the total cost estimated at about $52,000, of which the balance will be paid this year.

Another interesting item in publications is the amount spent on Emergency Alternate Provisions and Emergency Specifications, the total over the past three years representing about $12,000, which is a direct contribution to the war effort.

Balance:

The favorable operating balance was about $15,600, roughly 6 per cent of total receipts. Of this amount, about $6000 was transferred to the general surplus, the balance being earmarked for special purposes. General surplus at the end of the year, exclusive of special and designated funds and reserves, was $111,606, which is somewhat less than half a year's operating expenses at present levels.

Income Dollar and How Used:

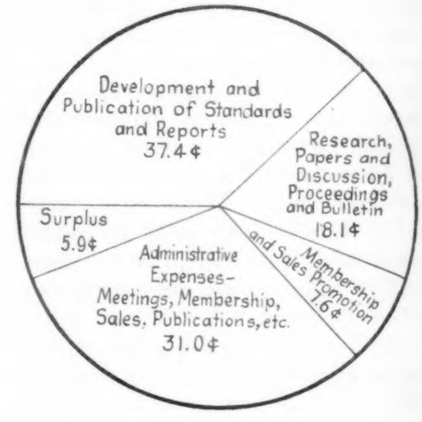
As visual aids in grasping quickly a broad picture of A.S.T.M. 1944 finances, there are reproduced here two diagrams, one showing the source of the income dollar, the other how the income dollar was used. From the upper chart, one can determine quickly the percentage of income from dues, for example. A reference to the lower chart shows the large segment, and consequently considerable percentage of the expenditures, devoted to the Society's standardization work, one of its two major purposes. This, with the portion devoted to development and publication of data on properties of materials and testing, represents more than half of the expenditures. The portions devoted to membership, sales promotion, and administrative expenses are somewhat higher than for 1943, while the "surplus" from the income dollar is considerably decreased.

1945 BUDGET

In preparing the budget for 1945, the Executive Committee has continued its conservative policy in estimating current operating receipts at $290,000. Of this amount, $125,000 is expected from dues; $142,000 from sales of publications; $23,000 from advertising, interest, and miscellaneous items.

Estimated disbursements total $297,000, requiring the addition of $7000 from surplus to current receipts to balance the budget. The budget for disbursements provides about $123,000 for publications and $98,600 for salaries, with an additional $7000 for expansion of the technical and secretarial staff. Provision is also made for increased expenses incident to membership growth and higher costs of operation. An item of $2100 is included for contingencies, in view of the many uncertainties that face the Society this year.

INCOME DOLLAR



EXPENSE DOLLAR

A.A.T.C.C. Yearbook

THE 1944 Yearbook (21st edition) of the American Association of Textile Chemists and Colorists will prove invaluable to chemists, colorists, and others concerned with the application of dyes and chemicals to textiles. Among the data included are the latest standard test methods of the Association, a classified list of all dyestuffs currently manufactured in the United States, a similar list of textile chemical specialties, and a bibliography of articles on textile chemistry and processing published in 1943. In addition, this edition contains reports of the research committee, and its subcommittees.

Copies of the publication can be obtained from Howes Publishing Co., Inc.; 1 Madison Ave., New York 10, N. Y. at $3.50.

Intensified Work on Shipping Containers Gets Under Way

Committee D-10 Reorganizes and Approves Test Methods

Some forty of the country's leading authorities on the quality and testing of shipping containers of all kinds attended the all-day meeting of Committee D-10 on Shipping Containers at the Hotel Pennsylvania in New York on March 22. For several weeks prior to the meeting the committee officers, Chairman Edward Dahill, Chief Engineer, Freight Container Bureau, Association of American Railroads, and Secretary Earl R. Stivers, Director, Package Research Laboratory, together with the Staff, had been perfecting organization details including a very considerable expansion in the personnel to insure that many of the leading container fields were represented. Also several proposed test methods had been distributed to the existing D-10 personnel late last year and these had been re-edited and were intensively discussed. Three of them were approved for submission to the Society, subject to favorable letter ballot.

A. S. T. M. Secretary-Treasurer C. L. Warwick was present and he explained to the meeting the Society's desire to intensify its work in the field, the request that had come from the War Production Board Container Coordinating Committee that recognized standard tests and performance specifications be set up, and that the Society would aid the committee in any way possible.

In opening the meeting, Mr. Dahill detailed the scope of the committee as it has been established by the A.S.T.M. Executive Committee as follows:

> The formulation of performance specifications, methods of test, and definitions of terms pertaining to shipping containers. The term "shipping container" as used herein shall mean the complete container with any or all interior packing.

Administrative Matters

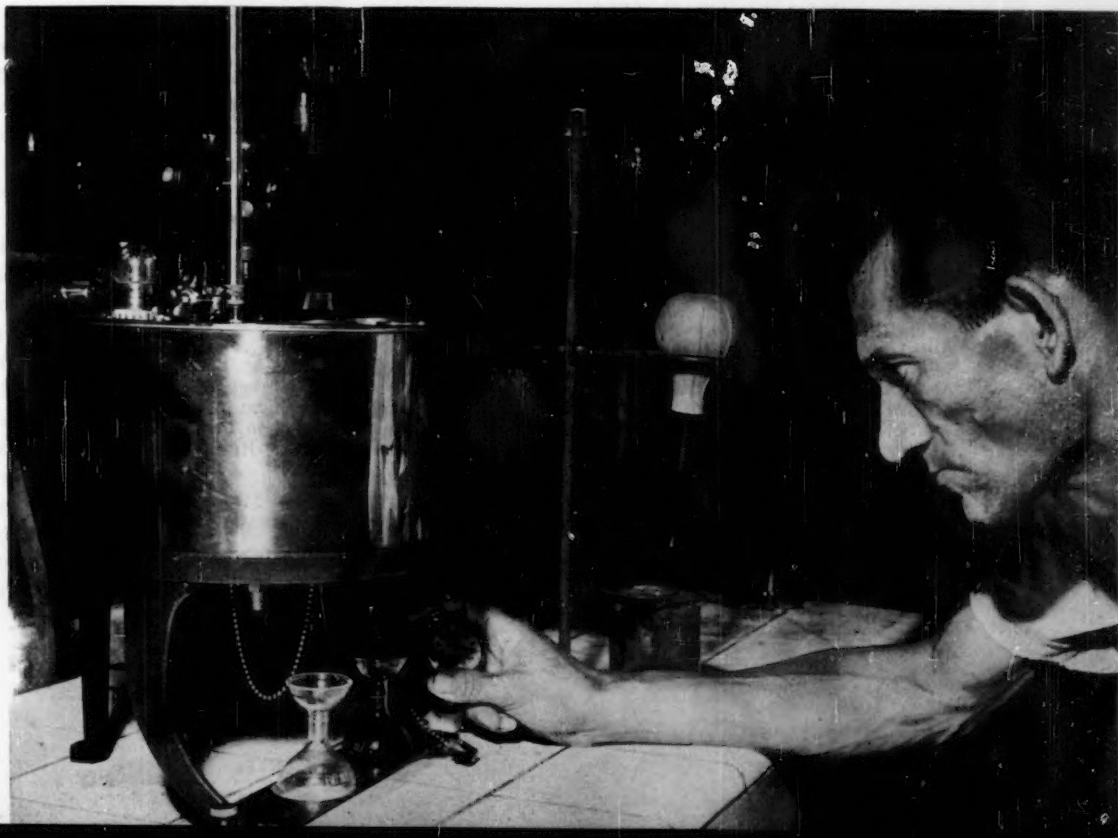
During the morning session the committee perfected a number of administrative details including new by-laws, the election of a vice-chairman and advisory committee, and discussed the setup of subcommittees and those who would serve on the subgroups.

R. L. Beach, General Electric Co., who has been very active in the work of Committee D-6 on Paper and Paper Products, was honored by election as vice-chairman. The Advisory personnel is given below. While the committee plans to handle as much work as possible by correspondence to ease the travel load and time of members, normally the group will try to convene in the spring and fall.

Standards

Prior to the meeting, five proposed tentative methods of testing had been submitted to the members for study and most of the four-hour afternoon session was spent in going over the methods to bring them in line with the consensus of the meeting. The free and full discussion of various aspects of the proposals resulted in a much better conception of what was intended and this procedure again demonstrated the soundness of the Society's basic philosophy in bringing consumers, producers, and general interests together so that when finally issued a proposed tentative specification or test will be closely in line with industrial practice. The meeting was cognizant that before final adoption as standard by the Society a number of changes and additions may be incorporated. A list of the five proposals follows:

Proposed Tentative Methods of:
- Test for Shipping Containers in Revolving Hexagonal Drum Box Testing Machine
- Drop Test for Shipping Containers
- Compression Test for Shipping Containers
- Incline-Impact Test for Shipping Containers
- Vibration Test for Shipping Containers



Testing viscosity, using A.S.T.M. Test for Viscosity by Means of the Saybolt Viscosimeter (D 88), at the Refinery Laboratory of Creole Petroleum Corp., a Standard Oil Co. of New Jersey subsidiary. This laboratory is at one of the refineries in Venezuela (La Salina), an article on this particular development having appeared in the February issue of *The Lamp*, house organ of Standard Oil Co. of New Jersey.

Cut Courtesy of "The Lamp"

The first three methods noted were approved after revision for submission to letter ballot and reference to the Society for publication as tentative. The incline-impact or Conbur test and the vibration test were discussed in great detail and finally were referred back to the Subcommittee on Test Methods for further consideration of the questions raised.

The scope clauses of the three methods to be voted on are substantially as follows:

Drum Test:

This method of test covers two procedures for performing tests or loading containers, as follows: Procedure A, to determine the ability of the container to withstand rough handling, and Procedure B, to determine the ability of the container to provide protection to its contents.

Drop Test:

This method of test covers two procedures for making drop tests on loaded containers, either of which may be used to compare the characteristics of a given design of container with a standard or to compare the characteristics of containers differing in construction.

Compression Test:

This method of test covers procedures for determining the ability of containers to resist external compressive loads applied to the faces and to diagonally opposite corners or edges of the containers, usually without contents.

Subcommittees and Membership

A condensed list of the committee personnel, officers and Advisory Committee follows:

Personnel of Committee D-10 on Shipping Containers

Chairman: Edward Dahill, Association of American Railroads, 30 Vesey St., New York 7, N. Y.
Vice-Chairman: R. L. Beach, General Electric Co., Schenectady, N. Y.
Secretary: E. R. Stivers, Package Research Laboratory, Rockaway, N. J.

Advisory Committee

Messrs. Dahill, Beach, Stivers, Lahey, Lincoln, Markwardt, Tufts, Weber, Wilkins.

Membership

Acme Steel Co., J. E. Ott
American Cyanamid Co., R. W. Lahey
Allis-Chalmers Manufacturing Co., S. E. Tray
Association of American Railroads, Edward Dahill (Freight Container Bureau) R. S. Hunt (Bureau of Explosives)
Balster, Wilmer J.
Bemis Brothers Bag Co., Arnold N. Weeks
Bethlehem Steel Co., John F. Pelly
Bird, Harlan H. (Conservation Officer Staff, War Production Board)
Bird & Son, Inc., Ralph A. Wilkins
California Wirebound Box Distributors, Taylor L. Gaugh
Canada Forest Products Laboratories; Department of Mines and Resources, T. A. McElhanney
Carlson, T. A. (U. S. Forest Products Laboratory)
Carnegie-Illinois Steel Corp., C. E. Miller
Chase Bag Co., C. P. Spring
Clark, J. D'Arcy (Subsistence Research and Development Lab., Chicago Quartermaster Depot)
Container Corp. of America, R. A. Diehm
Container Co. Division of Continental Can Co., H. A. Bergstrom
Container Coordinating Committee, WPB, H. A. Wolsdorf
Dallas, G. M. (Railway Express Agency)
du Pont de Nemours & Co., Inc.; E. I., Philip P. Kennedy
Fowler, N. A. (General Box Co.)
General Electric Co., R. L. Beach
General Motors Corp., General Motors Overseas Operations, A. D. Peister
Gerrard Steel Strapping Co., E. C. Barker
Great Southern Box Co., (Le Roy Blaum)
International Harvester Co., R. F. Weber
Lincoln, W. B., Jr. (Inland Container Corp.)
Luhrs, A. W. (Container Testing Labs., Inc.)
Malcolmson, J. D. (Robert Gair Co., Inc.)
Marathon Corp. (W. H. Graebner)
Markwardt, L. J. (U. S. Forest Products Lab.)
Merck & Co., Inc., E. E. Rumple
Montgomery Ward & Co., J. N. Hamilton
Mullen, E. G. (W. Ralston & Co., Inc.)
National Bureau of Standards, C. G. Weber
National Tube Co., H. R. Redington
National Wooden Box Assn., J. H. Dobbin
New England Box Co., Nathan Tufts
Owens-Illinois Glass Co., J. H. Toulouse
Republic Steel Corp., E. I. Burke
Sears, Roebuck & Co., W. H. Taylor
St. Regis Paper Co., C. H. Hartman
Stivers, E. R. (Package Research Lab.)
Swift & Co., J. H. Clark
United Air Lines, C. P. Graddick
U. S. Forest Products Lab., C. E. Hrubesky
U. S. Navy Department, Bureau of Ships
U. S. War Department, J. C. Babson (Corps of Engineers); Lee Hickox (Quartermaster Corps); F. R. Fetherston (Army Service Forces)
Wellford, Walker L. (Chickasaw Wood Products Co.)
Westinghouse Electric and Mfg. Co., W. B. Keefe
Wilson & Co., E. W. Foote
Worden, Edwin S. (U. S. War Dept.)

The following six subcommittees were authorized.

Subcommittee I on Definitions of Terms

Edward Dahill, *Chairman;* Messrs. Beach, Bird, J. H. Clark, Fowler, Hickox, Markwardt, Redington, Spring, Taylor, Tufts, Wilkins.

Subcommittee II on Methods of Testing

E. R. Stivers, *Chairman;* T. A. Carlson, *Secretary;* Messrs. Barker, Bergstrom, Balster, Dobbin, Fetherston, Graddick, Hunt, Keefe, Malcolmson, McElhanney, Bureau of Ships, Peister, Rumple, Spring, Toulouse, Worden.

Subcommittee III on Moisture and Water Vapor Resistance

R. W. Lahey, *Chairman;* Messrs. Bergstrom, J. D'A. Clark, Diehm, Foote, Hrubesky, Mullen, G. S. Weber, Weeks.

Subcommittee IV on Performance Standards

R. F. Weber, *Chairman;* Messrs. Beach, Carlson, J. H. Clark, Dobbin, Foote, Gaugh, Hartman, Kennedy, Malcolmson, Ott, Pelly, Peister, Toulouse, Wellford, Wolsdorf.

Subcommittee V on Correlation of Tests and Test Results

L. J. Markwardt, *Chairman;* Messrs. Barker, Burke, J. D'A. Clark, Fetherston, Keefe, Kennedy, Lincoln, McElhanney, Miller, Tray, Weeks, Wilkins.

Subcommittee VI on Interior Packing

W. B. Lincoln, *Chairman;* Messrs. Dallas, Dean, Diehm, Fowler, Hunt, Miller, Rumple, Taylor, Toulouse, Tray, R. F. Weber, Worden.

While exact statements of scope are to be developed, it was felt there was a great deal of work for each of the groups at this stage particularly for the Subcommittee on Methods of Testing. The list of subcommittee personnel is tentative, subject to acceptance of all of the members and also additions may be made from time to time.

One of the subcommittees, Mr. Lahey's group on moisture and water vapor resistance, met during the lunch hour and decided to undertake certain exploratory work which it is hoped may result in drafts of acceptable procedures for making essential determinations in this field.

Committee on Wires for Electric Conductors Meets

At its meeting in New York City on March 16, Committee B-1 on Copper and Copper-Alloy Wires for Electrical Conductors approved several actions involving the specifications and tests for which the group is sponsor. These actions will be subject to confirming letter ballot before submission to the Society. The meeting was one of the best attended in recent years, with some 40 members present. J. H. Foote, Commonwealth and Southern Corp., Committee Chairman, presided.

One important matter considered in the all-day session was the proposal that recent changes in the metal supply picture might make it desirable for Committee B-1 to formulate specifications for wire for electrical conductors made of aluminum and other metals as well as copper.

Revisions are to be recommended in two of the committee's widely used specifications, one, B 33 – 39, covering tinned soft or annealed copper wire, in which details covering the mechanical tests of adhesion of coating will be incorporated. In the other standard, B 48 – 42, soft rectangular and square wire, the committee will clarify certain requirements with a new table giving radii of corners of square and rectangular wire.

In the Tentative Specifications B 174, covering bunch-stranded copper conductors for electrical conductors, the committee in cooperation with the Underwriter's Laboratory has agreed on are wording and rearrangement of the section regarding variation in area and cross-sectional tolerances.

A number of editorial changes were approved in the tentative method for determining the resistivity of copper and copper alloy conductors, B 193 – 44 T, which test was approved for publication last August. A similar standardized method for wires and cables is being developed.

A broad project being developed in the committee involves issuance of separate standards covering test methods, several of which are now in the specifications.

Electrical Heating Alloys

COMMITTEE B-4 on Electrical-Heating, Electrical-Resistance and Electric-Furnace Alloys and a number of subcommittees met in New York at the Engineering Societies Building on February 8 and 9, with Chairman Dean Harvey presiding. Of particular interest was the action to set up four new sections under Subcommittee VIII on Metallic Materials for Radio Tubes and Incandescent Lamps. These four sections are constituted at the request of various representatives of the electronics industry to work on the establishment of a standard test for evaluating the emissivity of cathode nickel. The four groups will work under the general direction of R. L. Nelms of the Superior Tube Company. The Metallurgical Section will be under the chairmanship of E. A. Lederer, Radio Corporation of America; the Chemical Section will be headed by L. A. Wooten, Bell Telephone Laboratories; Presentation of Data on Production Tests is to be under the chairmanship of W. S. Bowie, Sylvania Electric Products and the Section on Standardizing the Diode Test will be directed by R. L. McCormack, Raytheon Mfg. Co.

Among other important actions was the arrangement made by Subcommittee V, J. W. Harsch, Chairman, to review data on the subject of the various tests incorporated in Specification B 190, for 25 per cent chromium, 12 per cent nickel castings for high-temperature service for electric furnaces.

Subcommittee VIII, in addition to making the arrangements for increased activity noted above, held a well-attended meeting at which many subjects were considered as did, also, Subcommittees X on Contact Materials and VII on Thermostat Metals.

Metal Powders and Metal Powder Products

THE third meeting since its organization in February, 1944, was held by Committee B-9 on Metal Powders and Metal Powder Products in Pittsburgh on February 28. The meeting of the main committee was preceded by meetings of three of its subcommittees. In the short time that this committee has been functioning it has made rather remarkable progress as evidenced by several new specifications and methods of test which will be presented to the Society this year and the number of matters under consideration in the committee. One of the most important items acted on at the meeting was new proposed Tentative Specifications for Metal Powder Sintered Bearings (Oil Impregnated). These specifications cover a bronze-base type and an iron-base type, each with two classes. In addition to prescribing the detailed chemical composition, the specifications define such characteristics as density, porosity, and radial crushing strength of such bearings together with descriptions of the test methods.

The Subcommittee on Metal Powder Products is also giving consideration to cemented carbides, flexure and hardness tests, and chemical analysis and grain size determinations. A Section on Friction Materials has recently been organized and will develop a program at its next meeting. Consideration is being given by the Section on Electrical Parts to characteristics, tests, and specifications for pole pieces made from metal powders and also to electrical contacts made from metal powders.

The Subcommittee on Metal Powders has been actively studying a number of test methods. Action was taken at the meeting on three of these tests which will be presented to the Society after letter ballot approval by Committee B-9 for publication as tentative. They include a method for sieve analysis of granular metal powders, a test for determining the rate of flow, and a method for apparent density of metal powders. Other methods under study by the committee include tests for compressibility, chemical analysis, subsieve analysis, and total iron content of iron powders.

The Subcommittee on Nomenclature has been very active and has compiled a list containing about 125 terms peculiar to powder metallurgy. Agreement has been reached on about 25 of these terms which are to be published as information.

Committee on Copper and Copper Alloys

THE three day meeting of Committee B-5 on Copper and Copper Alloys held in New York, March 12 to 14, inclusive, was the first held by the committee since its reorganization into three groups of subcommittees: on wrought products, on castings and ingots for remelting, and on correlation. The meetings originally had been scheduled for Pittsburgh during A.S.T.M. Committee Week, but were postponed and New York was selected in order to minimize travel for many of the members.

Action on Standards

The committee will retain emer-

gency alternate provisions which permit alternate forms of test bars for castings. Data are being developed by the Non-Ferrous Ingot Metal Institute through a research project at Battelle Memorial Institute and when available the committee will consider the data in relation to test bar requirements.

The emergency alternate for Free-Cutting Brass Rod, EA B 16, was retained as it was felt that the wider limits for impurities therein permitted should not be incorporated in the regular specification. All of the emergency alternate specifications which the committee had written for the primary purpose of permitting the use of fire-refined copper, ES 7, are to be withdrawn and this type of copper added to the regular specifications. This action will involve the canceling of EA B 111, EA B 122, EA B 135, EA B 148a, and EA B 171.

One of the very worth-while accomplishments of the committee has been the development of a Classification of Cast Copper-Base Alloys, first issued in 1939 and revised the following year. This tentative classification, B 119, following minor changes is to be recommended for adoption as standard.

A number of minor changes were approved in several of the casting specifications and in the corresponding requirements for ingots. Subcommittees will devote further study to a number of additional recommendations. Proposals to modify specifications for Steam or Valve Bronze Castings, B61, and B62, were received and will be studied. The proposals involve primarily rewriting the specifications to cover valves and fittings made up for stock and sold "off the shelf."

The tentative specifications for beryllium-copper, B 120 - 41 T, are to be retained in that status pending work under way which would result in four new specifications. Drafts are being prepared of requirements covering beryllium-copper sheet and strip, and also sheet and strip in the spring grade as well as beryllium-copper rods and bars and beryllium-copper wire. One problem on which there had been a difference of opinion has been reconciled with an agreement on chemical requirements.

In the specification for copper-nickel-zinc and copper-nickel alloy, sheet and strip, B 122, a new alloy is being added and tolerances eventually will be revised. So that requirements on conductivity will be applicable only when so specified, revisions are recommended in the copper sheet, strip, and plate Specification B 152. Some minor changes in chemical composition also will be made and the resistivity requirements changed slightly.

In Specifications B 99 - 42, Copper-Silicon Wire for General Purposes, the scope was changed to include hexagons and octagons, tolerances for which will be included in a new table being added to the specifications. Table II was clarified by notes calling attention to the fact that hard and spring tempers are not generally available in the larger sizes. The specifications were continued as standard with these changes.

In the field of pipe and tube specifications, the hydrostatic testing requirements in Specifications B 42 - 43, B 43 - 42, B 75 - 43T, and B 88 - 41 covering copper pipe, brass pipe, and copper tube were revised. In Specifications B 111 - 43 for Copper and Copper Alloy Seamless Condenser Tubes and Ferrule Stock, the maximum iron for the 70-30 cupro-nickel alloy was raised to 0.60 per cent, a maximum of 0.35 per cent arsenic added for the aluminum bronze alloy and the minimum copper for arsenical copper tubes reduced to 99.40 per cent. With other minor changes, these specifications are to be retained as standard.

The practice of testing full-size rod specimens *versus* machined tension test specimens and the question of using a uniform gage length for elongation measurements were both referred to the Subcommittee on Testing. The question of establishing uniform requirements and terminology for edge contours of bar and wire was referred back to a sub-subcommittee for further clarification.

The Specification for Copper-Base Alloy Forging Rods, Bars and Shapes, B 124 - 44T, will be recommended for adoption as standard and notes will be added to eight specifications for bars and shapes calling attention to the fact that forging rod should be ordered to Specification B 124.

With a note added to the scope clause to point out the practical limitations of the test, Method B 153 - 44 T, Expansion (Pin Test) of Copper and Copper Alloy Tubing is being recommended for adoption as standard.

In reviewing Method B 154 - 41 T, Mercurous Nitrate Test for Copper and Copper Alloys, it was noted that the solution used should contain 13 ml. of HNO_3 instead of 10 ml. With this change it was voted to adopt the method as standard. Cross reference to this method will also be made in appropriate specifications.

Many Actions at Meeting of Committee D-2 on Petroleum Products and Lubricants

At the intensive three-day series of meetings of A.S.T.M. Committee D-2 and its subcommittees in Detroit, January 13–16, inclusive, many important reports were received from subcommittees which have active programs under way in the ramified fields of activity covered by this Committee on Petroleum Products and Lubricants. In addition to discussion on standards and research, there were two informal symposiums, one involving neutralization, the other dealing with lubricating greases.

In the neutralization session there were papers as follows:

1. General Industries Viewpoint—C. L. Pope
2. Contribution of Technical Committee C on Turbine Oils—F. C. Linn
3. Contribution of Shell Oil Co., Inc.—G. H. Von Fuchs
4. The Automotive Industry—H. R. Wolf
5. The Standard Oil Co. (Indiana) Method—C. M. Loane

The two papers in the discussion on grease, the first discussing A.S.-T.M. past work by H. A. McConville, the second by T. G. Roehner discussing cooperative grease programs, are published in this ASTM BULLETIN.

In accepting the resignation of its veteran secretary, Dr. R. P. Anderson, who had retired from the staff of the American Petroleum Institute, the committee by rising vote expressed its appreciation of his long and valued services by electing him an Honorary Member of Committee D-2. David V. Stroop of the API staff was appointed acting secretary to serve until Dr. Anderson's successor is elected.

Technical Activities:

In its work on measuring viscosity, the committee has developed certain suggestions and thermometers for low-temperature use, and plans to incorporate in the Methods of Test for Kinematic Viscosity (D 445) instructions on precautions which should be taken at low temperatures.

Because the patent has expired on the Union Colorimeter (D 155), the committee will recommend to the Society that the requirement involving the specified name plate be deleted. Cooperative work has been under way evaluating a photoelectric relative color density method to replace the usual visual method.

The Subcommittee on Sulfur Determination reported cooperative tests had been carried out on certain aromatic hydrocarbon mixtures including motor benzol and cumene, the results showing that close reproducibility could be obtained. Methods used are covered in the A.S.T.M. Methods of Test for Sulfur in Oils (D 90).

Based on work in determining inorganic elements, a method has been approved by the Society, ES – 43, covering determination of sulfated residue. This is important to provide a standard method of checking new oils quickly so that no mistakes will have developed in compounding additives. The method had been requested by military forces.

To determine reasonable reproducibility limits in the widely used Methods for Flash Point (D 92), three oils were being tested in cooperative work which resulted in a recommendation that, with the same operator and facilities, results should not differ by more than 5 F. For different operators and facilities there might be a variation of 10 F. Certain other precautions will be recommended for addition to this method. Studies continue on procedures for detecting explosive vapors in fuel oil.

In the field of cloud and pour testing, it is hoped to publish as information with the committee's annual report a method for estimating maximum pour points of lubricating oils containing pour point depressants. In this work extending over the past 18 months, at least seven different procedures were evaluated using 19 selected oils. After study of the extensive data resulting, the subcommittee recommended publication as information so that results of field testing and reports from wider applications could be obtained. Because of lack of agreement in certain cooperative tests for aniline point of oils with a color darker than 8 NPA, the cooperative work will continue.

As an example of the varied problems and ramifications in the committee's work, an item involving illuminating oils could be mentioned where in Methods D 187, burning quality of kerosine oils, the Miller No. 2 Sun Hinge Burners have been entirely exhausted, and military and other authorities were unable to secure equipment. The committee in charge located an extensive supply of burners, which while not meeting all specifications were quite similar and has recommended the use of an alternate procedure for the Plume and Atwood No. 349 No. 2 Sun Hinge Burner.

In its 1944 report, the committee included for information methods of analysis of petroleum sulfonates. These are to be recommended for approval as tentative standards after some changes and corrections.

Quite a number of committee members are active in work involving analysis of petroleum products for hydrocarbon types. Several methods have been issued including Test for Olefins, Aromatics, Paraffins, and Naphthenes in Aviation Gasoline Without Distillation into Fractions (ES – 45); and Test for Benzene, Toluene, and High-Boiling Aromatics in Aviation Gasoline (ES – 46). Other problems being studied in cooperative research involve determination of olefinic unsaturation by chemical methods; analysis of hydrocarbons by adsorption; refractive index, dispersion and density; and determination of purity of hydrocarbons by freezing point.

On two previous occasions the committee has had published as information a test for potential gum in aviation gasoline. This is now to be submitted for ballot as a tentative standard.

Technical Committee B on Lubricating Oils is effecting an extensive reorganization involving "utility" sections, "quality" sections, and "general" sections; the first to study the relation between test data and service performance of lubricants and prepare specifications, classifications, and other general information, with the second to study and develop information on specific properties of lubricants, and the third to cover problems of standardization, editorial questions, and nomenclature.

There is much activity on turbine oils with members studying rusting, oxidation tests and emulsion tests, the latter covering the Whipper Modified Steam and Air Agitation Methods on eight samples.

The newly organized Technical Committee G on Lubricating Grease held a lengthy meeting with a large attendance and among other matters will form three working sections: I, on Chemical and General Laboratory Tests for Lubricating Greases; II, on Consistency Measurements and Related Physical Tests of Lubricating Greases; and III, on Functional Tests for Lubricating Greases Employing Antifriction Bearings.

Many of the actions noted above are subject to letter ballot confirmation in the main committee with details to be given in the 1945 report of the committee.

At the Detroit meeting, Chairman T. A. Boyd, Head, Fuel Dept., Research Laboratories Division, General Motors Corp., Detroit, Mich., presided.

Thermal Insulating Materials

A very interesting and well-attended series of meetings of the subcommittees of Committee C-16 on Thermal Insulating Materials were held in Pittsburgh on February 26 to 28 and action was taken on a number of recommendations to be presented to the Society.

The subcommittee on physical properties of preformed block insulation will recommend the adoption as standard of the compression test now described in Tentative Methods C 165 – 41 T. An explanatory note will be added pointing out that certain types of insulating materials may be compressed to deformations greater than 5 per cent without failure and that this compression at higher deformations may in some cases be desired. The flexure test now described in Methods C 165 will be continued as tentative, but published under its own serial designation. The committee plans to give further consideration to the flexure test.

The subcommittee on physical properties of thermal insulating cement reviewed thoroughly the several specifications and methods under its jurisdiction and reached decisions on certain cooperative work to be undertaken during the year. It will recommend for adoption the Tentative Methods of Test for Covering Capacity and Volume Change Upon Drying (C 166 – 41 T), with a revision in the test procedure requiring adequate circulation of the oven atmosphere during drying of the test specimen. This same provision will also be added in the test procedures for thermal conductivity and adhesion to steel appearing in the specifications for 85 per cent magnesia (C 193), asbestos (C 194), mineral wool (C 195), expanded or exfoliated vermiculite (C 196), and diatomaceous silica (C 197) thermal insulating cements.

A cooperative series of tests are to be undertaken on the method for determining adhesion to steel in order to compare the Navy method with those developed by other members of the committee. It is expected that the improved method which should result from this work will be substituted for the present Navy test now appearing in the several A.S.T.M. specifications. The tentative specifications (C 195 – 44 T) will be revised to require the thermal conductivity at a temperature of 200 F. to be "0.70" rather than "0.80" Btu. per sq. ft. per hr. per deg. Fahr.

Subcommittee IV on Physical Properties of Blanket and Semirigid Insulation reviewed the three emergency specifications for blanket thermal insulation for building purposes (ES – 14), for industrial purposes (ES – 15), and for refrigeration purposes (ES – 16). This resulted in a recommendation that these emergency specifications be discontinued since they are not considered sufficiently comprehensive to warrant advancement to the status of tentative. An outline of a new specification for blanket insulation for building purposes was discussed but it was agreed certain features should be given further study. Two subsections are to investigate the properties of fire and flame resistance, and study the effect of water and moisture.

Subcommittee V on Physical Properties of Loose-Fill Insulation has subdivided its work into two sections—one on organic materials, the other on inorganic materials. The work will be further subdivided to consider granular, fibrous, and powdered materials. After detailed discussion, proposed properties for characteristics of loose-fill insulation were established and it was agreed that test procedures for such characteristics should be prepared. The committee also decided to develop a use specification in which a range of temperature limits will be incorporated as a control.

The following properties of thermal insulation which might properly come under Subcommittee VII on Measurement of Thermal Properties Other Than Thermal Conductivity were discussed: (1) heat stability, (2) heat shrinkage, and (3) shrinkage. It was decided to undertake work on items (1) and (2) for block insulation with the object of preparing a test method for shrinkage and at least making a good start on a stability test method.

In the work on studies of vapor barriers the subcommittee developed the unit for vapor transmission in its final form. Also a proposed method for determining the permeability of relatively thin membranes was partially completed.

Chemical Analysis of Metals

The A.S.T.M. methods of chemical analysis of metals have been under review this year by Committee E-3. A meeting of the Ferrous Division was held in Pittsburgh early in February. A method for the determination of sulfur in steels by combustion has been completed and will be submitted for publication as tentative. This committee has also developed methods for the determination of aluminum, tin, and boron.

Three subcommittees of the Division on Non-Ferrous Metals met in Boston on March 5. At this meeting the Section on Copper, Nickel, and Their Alloys took action to present to the Society new Tentative Methods for Chemical Analysis of Special Brasses and Bronzes. The committee also decided at this meeting to bring up to date the Methods of Battery Assay of Copper which were first issued over 25 years ago. The revised procedures will be entitled "Methods of Electroanalysis of Copper" and will be applicable to copper having a purity of 99.7 per cent and over, which will include electrolytic copper, low-resistance lake copper, and the low-grade or casting copper.

Another subcommittee completed new Tentative Methods for Analysis of White Metal Bearing Alloys. Certain of the procedures agreed upon are to be studied further by members of the committee through the analysis of a common test sample. Any refinements in the method that may develop as a result of these round-robin tests will be incorporated in the methods before final publication.

The recently organized section to consider absorptiometric methods has made excellent progress in the development of methods for photometric analysis. Detailed consideration was given at the meeting to the draft of methods for photometric analysis of pig lead which includes

procedures for determining bismuth by the thiourea method and iron by the *o*-phenanthroline method. A procedure for the photometric analysis of white metal bearing alloys has also been completed. This committee expects to complete during the coming year several additional methods for the analysis of other nonferrous alloys. The undertaking of these methods has resulted in part from the Symposium on Analytical Colorimetry and Photometry held during the 1944 Annual Meeting of the Society.

Committee E-3 will recommend to the Society this year the adoption as standard of the Tentative Methods of Chemical Analysis of Brasses (E 36 – 42 T), the Tentative Methods of Chemical Analysis of Slab Zinc (Spelter) (E 40 – 42 T), and the Tentative Methods of Zinc-Base Die-Casting Alloys (E 47 – 42 T).

Relationship of Stress Analysis, Design and Metallurgy—Topic of Philadelphia Meeting

At afternoon and evening sessions, sponsored by the Philadelphia District Committee, April 12, at the Franklin Institute, four leaders in the field of stress analysis, strain gaging, and design will speak. Plans for this local meeting have been under way for some months and the committee, in extending a cordial invitation to all those within commuting distance to attend, is very pleased to bring together on one platform leaders in this field. F. G. Tatnall, Past-Chairman of the Philadelphia District has been very active in planning and organizing the meeting with District Chairman L. E. Ekholm. A list of the speakers and their subjects follows:

Strain Gages and Strain Measuring Equipment
C. H. Gibbons, Application Engineer, Baldwin-Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa.

Structural Trends Dictated by High Speed
H. R. Gordon, Senior Aeronautical Engineer, Naval Air Experimental Station, Navy Yard, Philadelphia, Pa.

Effect of Residual Stresses on the Fatigue Strength of Structural Materials
J. O. Almen, Head Mechanical Engineer, Research Labs., General Motors Corp., Detroit, Mich.

Using More of the Inherent Fatigue Strength of Materials
O. J. Horger, Charge of Railway Engineering and Research, The Timken Roller Bearing Co., Canton, Ohio.

Buffalo and Cleveland District Meetings

At meetings in Buffalo and Cleveland on March 28 and 29, respectively, President P. H. Bates, Secretary-Treasurer C. L. Warwick, and N. L. Mochel, Manager, Metallurgical Engineering, Westinghouse Electric and Mfg. Co., Philadelphia, will speak. The meetings have been arranged by the respective A.S.T.M. district committees, so that Mr. Mochel and the officers can combine their visits in one trip. President Bates, in addition to remarks about A.S.T.M., will discuss some research activities and work at the National Bureau of Standards, particularly involving the field of materials. Mr. Mochel, chief technical speaker at each meeting, will give his lecture, "Shall It Be: Cast? Forged? or Welded?", and Mr. Warwick will outline some of the interesting new developments in the Society.

The Buffalo meeting is to be in two sessions, with Dr. C. C. Furnas, Director of Research, Airplane Div., Curtiss-Wright Corp., speaking at the evening session on "Future Trends in Aviation." A dinner will be served between the afternoon and evening meetings.

In Buffalo, District Chairman B. L. McCarthy and Secretary T. L. Mayer have been responsible for the arrangements, as have been Chairman A. J. Tuscany and Secretary Ray T. Bayless in Cleveland.

News accounts of these meetings will appear in the May Bulletin.

Use of A.S.T.M. Standards

The accompanying photograph of Locomotive No. 2737, furnished the United States Army, is the seventy-thousandth locomotive built by the Baldwin Locomotive Works. This engine was completed early last year and was one of a large pool of similar locomotives used in Italy. Communications from the armed services have noted the reliability of American locomotives and stress the very important part they have had in the war effort.

In the construction of this locomotive A.S.T.M. standards had a part in connection with certain forgings and castings. Many of the A.A.R. specifications were, of course, embodied in the requirements for the materials. Mr. Ralph Kelly, President, Baldwin Locomotive Works, who was the dinner speaker at an A.S.T.M. district meeting last fall, views his company's seventy-thousandth engine.

New Secretaries of Committees D-2 and D-16

In addition to the relinquishment of his activities in the American Petroleum Institute, where he has been Secretary of the Division of Refining for many years, Dr. R. P. Anderson has resigned as secretary of A.S.T.M. Committee D-2 on Petroleum Products and Lubricants, in which capacity he has served for many years, and also as secretary of Committee D-16 on Aromatic Hydrocarbons. D. V. Stroop, American Petroleum Institute, 50 W. Fiftieth St., New York 20, N. Y., is serving as acting secretary of Committee D-2, and W. L. Douthett, The Texas Co., 135 E. Forty-second St., New York 17, N. Y., as acting secretary of the relatively new standing Committee D-16. Further information is given in this Bulletin concerning Dr. Anderson's extensive and long-time work in the Society.

West Coast Aircraft Men on A.S.T.M. Committees

ARRANGEMENTS have been completed for direct participation in the Society's committee work on the part of the major Pacific Coast aircraft companies, all of whom are members of the Society. These companies have formed the Western Aircraft War Production Council (A.W.P.C.), and in addition to representing their companies the individuals selected to serve on the Society's committees will also represent A.W.P.C. through contacts that have been established with the Council's Specialists Panel on Testing and Research which deals with many problems directly in the field of A.S.T.M.

The aircraft industry is an extensive consumer of engineering materials and is also vitally interested in the establishment of methods of test that will provide the greatest possible fund of information regarding properties of materials in relation to their varied applications, inasmuch as designers of aircraft must utilize these properties to the fullest possible extent. In their visit to the Pacific Coast a year ago, the President and Secretary-Treasurer of the Society accordingly invited the companies making up the Aircraft War Production Council to participate more actively in the committee work of the Society.

For a start it was found desirable to select a limited number of A.S.T.M. committees in whose work the aircraft industry had the greatest immediate interest, and accordingly representation has been arranged on the following eight committees:

A-10 on Iron-Chromium, Iron-Chromium-Nickel and Related Alloys:
- W. G. HUBBELL, Ryan Aeronautical Co. San Diego, Calif.
- J. E. SEYMOUR, Process and Materials Analyst, Process Engineering Dept., Northrop Aircraft, Inc., Hawthorne, Calif.

B-7 on Light Metals and Alloys, Cast and Wrought:
- PAUL MOZLEY, Lockheed Aircraft Corp., Burbank, Calif.
- MAX TATMAN, Engineering Laboratories, Consolidated Vultee Aircraft Corp., San Diego, Calif.

D-11 on Rubber and Rubber-Like Materials:
- R. B. STRINGFIELD, Staff Process Engineer, Consolidated Vultee Aircraft Corp., Vultee Field, Calif.
- P. C. SILVERSTONE, Material and Process Engineer, North American Aviation, Inc., Inglewood, Calif.

D-20 on Plastics:
- F. J. KRIEGER, Research Engineer, Douglas Research Labs., Douglas Aircraft Co., Inc., Santa Monica, Calif.
- P. C. SILVERSTONE

E-1 on Methods of Testing:
- H. E. NORTH, Research Engineer, Douglas Aircraft Co., West Los Angeles, Calif.

E-7 on Radiographic Testing:
- J. F. TURBEVILLE, Northrop Aircraft Inc., Hawthorne, Calif.

Research Committee on Effect of Temperature on the Properties of Metals:
- H. E. NORTH

Research Committee on Fatigue of Metals:
- R. B. BLAND, Lockheed Aircraft Co., Burbank, Calif.

In the case of all but the two research committees, representation is in the name of the company indicated; but while the company holds the official membership their representatives also report to the Testing and Research Panel of A.W.P.C. where the work of the respective committees is discussed, comments on proposed tests and specifications developed, and from which also suggestions for work to be undertaken will be forthcoming.

This plan of representation was worked out by Luther P. Spalding, Chief Research Engineer, North American Aviation, Inc., during the Annual Meeting last June which he attended as the A.W.P.C. representative and as then chairman of the Testing and Research Panel. Nominations for membership on the committees were submitted last fall by H. O. Boyvey, Chief, Development Laboratories, Consolidated Vultee Aircraft Corp., who succeeded Mr. Spalding as chairman. The Society's thanks are due to these two members of the Society for the keen interest they have shown in perfecting these arrangements, which will make it possible for the Society to render important service to the aircraft industry and at the same time have brought to it by the industry itself a number of problems in the testing of materials upon which important work needs to be done. The present chairman of the A.W.-P.C. Testing and Research Panel is Hayden Gordon, Research Engineer, Ryan Aeronautical Co., San Diego.

R. E.
Hess

R. E Hess—25 Years with A.S.TM.

ON FEBRUARY 20, R. E. Hess, Assistant Secretary of the Society, celebrated unobtrusively, by being at his desk, twenty-five years of continuous service with the Society. He was Assistant to the Secretary for four years and has been Assistant Secretary since 1924. Born in Philadelphia, he received his degree of Bachelor of Science in Civil Engineering from the University of Pennsylvania. Concerned with a diversity of A.S.T.M. matters, his work involves especially the technical committee activities and the supervision of the Society's extensive publications. He serves as Secretary of Committee E-8 on Nomenclature and Definitions and of Committee E-10 on Standards.

In addition to an even-going and pleasant disposition which is an important asset in the hectic activities at Headquarters, the Assistant Secretary has a most remarkable memory, and of particular value in connection with publications, a most excellent editing sense including a vocabulary which permits only a precision of expression.

Because of the desire to have members of his family present, the dinner planned by the Staff for Mr. Hess on February 20 was postponed, to be held in the near future.

R. J. P.

New York War Production Conference

IN ADDITION to the A.S.T.M. New York District Committee which participated officially as one of the sponsors, there were many members of the Society and committee men participating in the

very successful War Production Conference sponsored by the New York Engineering Societies Committee. Nine comprehensive panels held in the afternoon and evening of January 30 featured the meeting and a dinner was also held, attended by 1200 technologists, at which notable addresses were presented by Lt. Col. J. R. Naylor, representative of the War Production Board, speaking on "Battle Conditions and Matériel Requirements," and R. E. Gillmor, President, Sperry Gyroscope Co., who gave an inspiring address on "The Creative Mind and Victory."

Myron Park Davis, Chairman of the A.S.T.M. District Committee and Secretary of the New York Societies Committee, has been very active in the conference.

Panels covered the following: Safety Engineering, Metals Industries, Who Can Help the Small Plant, Post-War Construction, Chemical Industries, Management and Manpower, Electronics—Present and Future Applications, Utilization of Metals and Alloys in Industry with Particular Reference to Transportation, and Wake Up American Business. A.S.T.M. participated in those on Post-War Construction and Chemical Industries. However, several members aided in developing other panels or were panel members including the following: J. S. Vanick Fred P. Peters, O. B. J. Fraser, Russell Franks, Robert H. Aborn, Albert J. Phillips, M. P. Davis, G. O. Hiers, H. Outcault, R. W. Burns, Ernest E. Thum, Sam Tour, N. E. Woldman, Leon C. Bibber and others. H. C. R. Carlson, Chairman, Engineering Societies Committee, and C. A. Heschelés, (chairman Promotion Committee) serve on the A.S.T.M. District Committee.

The Creative Mind and Victory[1]

My thesis is our Country's increasing dependence on its creative minds for victory. By creative minds I mean that relatively small minority with the talent and ability to make new contributions in research, invention, engineering, production, education, and administration in all the sciences and arts.

Most of us are so far removed from the struggle for existence that we are inclined to take victory and survival for granted. It is useful, therefore, to remind ourselves of the processes by which we have survived. We may refer to the process as the "origin of species" or "natural selection" or "adaptation to environment" or "survival of the fittest." Whatever name we give it, we know that the most basic and inevitable element in the process is conflict.

* * *

We of Sperry have a particular admiration for the gyroscopic automatic pilot of the Diptera, or two-winged insects—two tiny alternating gyroscopes, perfectly designed for maximum momentum with minimum weight; a muscular system to drive them; a nervous system to integrate their indications and to differentiate between linear and angular movements; and a wing control system for automatically executing the orders of the nervous system.

Probably the most mysterious of nature's mechanisms for aerial navigation is that which enables the birds to make long, over-water flights, arriving at precisely the same spot and with perfect timing year after year.

How infinitely wise the Creator who has linked together the necessarily finite existence of individuals to establish a continuity of life evolving ever and ever to higher forms! The more we learn of the survival mechanisms of other species, the better becomes our perspective for discussion of the survival mechanism of the genus *homo sapiens*—us, in other words.

What is the characteristic which has enabled man to become so powerful in so short a time? We are not very strong; our eyes, ears, and sense of smell are all inferior to many of the animals; we haven't any built-in gyroscopic automatic pilot or folding wings. What do we have? The answer is, of course, a mind—or, more accurately, a creative mind.

Man has not only survived, but has succeeded in changing his environment and extending and augmenting his physical powers. Physically equipped to move slowly on the solid earth, he travels with great speed in the air as well as on and under the sea and over the land. He has given himself supernatural powers in the five senses and with these powers can hear and see over great distances and through opaque obstacles. With the creative mind, man has invented means to record his experiences so that his knowledge can be passed on from one to the other and so that cooperation in groups is facilitated. Ideas have become of paramount importance. Nations are based upon ideas. Men have sought to evolve a form of society combining individual freedom with voluntary social cooperation. Our Country has attained the highest point ever reached in the evolution of that idea. We have produced an unusual number of creative minds. We have the greatest individual freedom and with it a productivity so great that we have difficulty in utilizing it in ordinary times. We wish peace because we cannot gain by war.

In nations where the level of living is low, it has always been possible for ambitious and intelligent leaders to convince the people that if they will subordinate themselves completely to the state, their lot can be very much improved. Prosperous and peaceful nations such as our own are in the greatest danger when they come to believe that peace is permanent for them. The Germans were aware that war is fought not only for ideas but with ideas, especially with scientific and engineering ideas for the instrumentalities of war. Our enemies were aware that the most powerful of all weapons is the creative mind. Since 1935 the very best creative minds in Germany were devoted exclusively to the evolution of ideas for war. As a consequence, the lightning war of 1940 nearly succeeded. It probably would have succeeded if they had taken a little more time to develop the weapons they now have.

Secretary Forrestal has said, "One of the reasons for the urgency of clinching our victory at the earliest moment arises from the fact that we have not won the war until we win it. We simply cannot be safe from sudden upsets based on scientific research until we stop all Axis war effort of every kind dead in its tracks." No more penetrating statement has been made. We cannot count on the end of the war until all Axis—German *and* Japanese—war effort of every kind has been stopped dead in its tracks. It is a mistake to underestimate the creative minds of the Japanese. They do not have as many as we, but all that they have are intensively engaged in adding to their military strength.

When we win a complete and decisive victory, we will still have the problem of national survival. We will be the largest nation with individual freedom and a high level of living in a world filled with war-torn, frustrated, "have-not" peoples. The wider dissemination of knowledge by reason of the rapid development of communication and transport will greatly increase the feeling of frustration of many hundreds of millions of people who have heretofore accepted their lot with little protest because they knew of nothing better. New leaders will arise and some,

[1] Excerpts from an address by R. E. Gillmor, President, Sperry Gyroscope Co., Inc., at the New York meeting sponsored by the Engineering Societies Committee on War Production, Jan. 30, 1945. Copies of the complete address can be obtained on written request to The Sperry Gyroscope Co.

as in the past, will seek war as a means of improving the lot of their people. How can we have peace? Professor Van Tyne has said, "We will never have universal peace until the strongest army and the strongest navy are in the hands of the most peaceful nation." The strongest army and navy does not mean the largest. A relatively small army and navy nearly won a lightning war in 1940. It will be possible for a relatively small force equipped with very superior weapons to wage a successful lightning war against a large but unwary and unprepared nation. Twice we have learned that lack of preparedness is an incitement to war—not a preventive of war. Twice we have been given time to prepare—it is not likely that we will be given that time again. Let us learn from history. Let us be strong. With strength and a desire for peace, we will have peace.

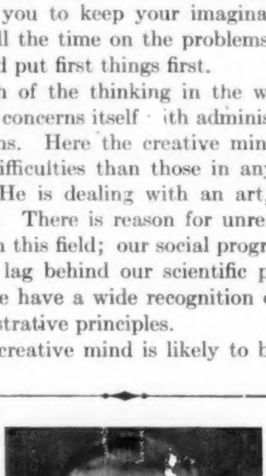
In war and peace the limitation on our military strength as well as our economic strength is established by the number, quality, and effectiveness of our creative minds. Never has it been so necessary for the creative mind to function so effectively on all that is concerned with survival; on invention and research in all the sciences and arts contributing to national security and social and economic progress. I urge you to keep your imagination at work all the time on the problems facing you and put first things first.

Much of the thinking in the world of science concerns itself with administrative problems. Here the creative mind faces more difficulties than those in any other field. He is dealing with an art, not a science. There is reason for unremitting effort in this field; our social progress will always lag behind our scientific progress until we have a wide recognition of good administrative principles.

The creative mind is likely to be most effective when it has freedom but, at the same time, the opportunity to be stimulated by the cooperative and competitive ideas of other creative minds. Whether this is so or not, we have to use our relatively few creative minds wherever we find them and the great majority are distributed widely all over the country—in industry, in the universities and in private laboratories, as well as in Government Services, who have the quality highly developed.

The welfare of all of us is inextricably linked together; for selfish as well as for altruistic reasons, each of us must accept the responsibility of being our brother's keeper. The creative minds carry an especially heavy responsibility, for on them depends our rate of progress toward a better world. Let us all find better ways of recognizing and encouraging them so that they can do more to help us.

Dr. R. P. Anderson Retires



A MEMBER of the Society since 1924, and Secretary of Committee D-2 on Petroleum Products and Lubricants beginning in 1925, Dr. R. P. Anderson who retired on December 31, 1944, carries with him the best wishes of a large group of friends and associates in the Society. Over the years he has contributed immeasurably to the advancement of the Society's work, particularly in the field of petroleum products and lubricants. A member of the A.S.T.M. Executive Committee (1942–1944) and of its important Committee E-10 on Standards (1935–1941), he had participated in other A.S.T.M. work and was currently serving as secretary of the relatively new Committee D-16 on Aromatic Hydrocarbons.

Better known as "Andy" to a host of friends in A.S.T.M., he was born at Savannah, N. Y., on February 22, 1887. He took his A.B. degree at Cornell in 1908, specializing in chemistry, and in 1912 he received his Ph.D. degree from Cornell. From 1907 to 1917 he was successively assistant instructor, instructor, and assistant professor in the Department of Chemistry. From 1917 to 1924 he was Chief Chemist for the United Natural Gas Company, Oil City, Pa., except for a short interval in 1918–1919 when he served as Captain, Chemical Warfare Service, stationed at laboratories in France. From 1924 to the end of 1944 he was associated with the American Petroleum Institute as technologist and also from 1930 as Secretary of the Division of Refining. In 1933 he represented A.S.T.M. and the A.P.I. as a U. S. delegate to the First World Petroleum Congress. He is a member of Sigma Xi, Gamma Alpha, and Alembic.

His great value to A.P.I. and to A.S.T.M. depended not only on his sound scientific knowledge but also on the thoroughness with which he considered every problem brought to him and the very unusual judgment that he was able to exercise. As a man of simple tastes he never found it difficult to find enjoyment in conversation, in the solving of difficult puzzles and mathematical problems, and is understood to be one of the most consistently good bridge players in any technical organization.

His retirement from active service is not, as has been rumored, the result of poor health but is rather the same intelligent attention to his physical and mental well-being that has characterized his treatment of technical and personnel problems for the last 35 years. He has located in Pennsylvania between Downingtown and Coatesville on a farm (his address is R. D. 4, Coatesville, Pa.) and is busily engaged in making a comfortable home out of an old farmhouse. Under date of March 11, 1945 he says, "I am working harder with my hands than at any time before for 30 odd years. I am not sure that I want to continue at this pace indefinitely but at present I am enjoying it." Having spent the winter months since January 1 in working indoors, he is now planning a rather large garden and is certain to find that human pests are not necessarily the most troublesome ones.

Catalogs and Literature Received

THE OHIO CHEMICAL AND MANUFACTURING CO., 1177 Marquette St., Cleveland, Ohio. Sixteen-page folder entitled "Equipment for Control and Storage of High Pressure Gases." Describes unit parts, pressure gages, rate gages, gasometer, flow meter, etc.

PRECISION SCIENTIFIC CO., 1750 N. Springfield Ave., Chicago 47, Ill. Bulletin HP-1650, a four-page leaflet, entitled "'Precision' Safety Heaters." Describes the features of these heaters, and gives other pertinent information. Also, leaflets describing a new Indexing Fixture for Jominy Hardenability Bars, and the Semi-Automatic Air Operated Metallurgical Specimen Mounting Press.

LEEDS & NORTHRUP CO., 4934 Stenton Ave., Philadelphia 44, Pa. Catalog E-54-460(1) (replacing E-54(1)), "To Measure Insulation Resistance—L&N Test Set Assemblies," eight pages. Also, Catalog N-00A(2), "Micromax Electric Control—Duration-Adjusting Type," 25 pages, explaining how by means of an "on-off" contacting system the heating unit is fed the electric current needed to keep temperature to the required control point or program. Illustrated.

TRIPLETT & BARTON, INC., Burbank, Calif. An informative booklet entitled "For Comparison," containing comprehensive data on the postwar possibilities of prefabrication, metallurgical, X-ray, and other scientific testing used so extensively in speeding up the war program. Issued if requester writes on firm letterhead giving position, and special interest in the testing field. Address Department 49.

PICKER X-RAY CORP., 300 Fourth Ave., New York 10, N. Y. Fifteen-page booklet entitled "Picker X-ray Production Inspection Equipment." The equipment is detailed with illustrations of various parts—the tube carriage, fluoroscopic chamber, exposure cabinet, etc.

NEW MEMBERS TO MARCH 7, 1945

The following 109 members were elected from January 18 to March 7, 1945:

Chicago District

GERRARD STEEL STRAPPING CO., E. C. Barker, Chief Engineer, 2915 W. Forty-seventh St., Chicago 32, Ill.

PERFEX CORP., V. R. Tate, Secretary, 500 W. Oklahoma Ave., Milwaukee 7, Wis.

UNITED AIR LINES, INC., J. A. Herlihy, Vice-President—Operations, 5959 S. Cicero Ave., Chicago 38, Ill.

BURMEISTER, ROBERT A., Materials Engineer, City of Milwaukee, Testing Lab., 3515 W. Clybourn St., Milwaukee 8, Wis.

HANSEN, WALDEMAR C., Manager, Research Labs., Universal Atlas Cement Co., Gary, Ind.

HAYES, T. D., Manager, Bar and Semi-Finished Materials Bureau, Carnegie-Illinois Steel Corp., 208 S. LaSalle St., Chicago 90, Ill.

LA PINE, ARTHUR S., President, Arthur S. La Pine and Co., 121 W. Hubbard St., Chicago 10, Ill.

RASCHER, CHARLES, President, Rascher & Betzold, 730 N. Franklin St., Chicago 10, Ill.

SCHOFIELD, L. B., Materials Engineer, Commonwealth Edison Co., 2233 S. Throop St., Chicago 8, Ill.

WISE, L. J., Assistant to Executive Vice-President, Chicago Malleable Castings Co., 1225 W. 120th St., Chicago 43, Ill.

Cleveland District

ENYEART, HAROLD F., Chief Development Engineer, Romec Pump Co.,* Abbe Rd., Elyria, Ohio.

HARDING, R. L., Senior Partner, Wilbur Watson and Associates, 4614 Prospect Ave., Cleveland 3, Ohio.

JOHNSON, E. R., Chief Metallurgical Engineer, Central Alloy District, Republic Steel Corp., 410 Oberlin Rd., S. W., Massillon, Ohio.

KAUFMAN, ROBERT R., Chief Engineer, Master Builders Co., 7016 Euclid Ave., Cleveland 3, Ohio.

MCGINLEY, EDWARD E., Chief Metallurgist, Carnegie-Illinois Steel Corp., Youngstown, Ohio. For mail: 63 Clifton Dr., Youngstown, Ohio.

RENWICK, W. EUGENE, Product Engineer, The Mansfield Brass Foundry, Inc., 287 N. Diamond St., Mansfield, Ohio.

ROMIG, E. W., Chief Engineer, Claud S. Gordon Co., 7016 Euclid Ave., Cleveland 3, Ohio.

Detroit District

ANALYTICAL ENGINEERING CENTER, Chester A. Grondzik, Executive Secretary, 8620 Epworth Blvd., Detroit 4, Mich.

KERR DENTAL MANUFACTURING CO., Robert M. Kerr, Jr., Vice-President, 6081–6095 Twelfth St., Detroit 8, Mich.

NASH-KELVINATOR CORP., William Mikulas, Engineer, 14250 Plymouth Rd., Detroit 32, Mich.

HINRICHS, LUTHER O., Testing Engineer, Ford Motor Co., Rouge Plant, Dearborn, Mich. For mail: 90 Hazelwood, Detroit 2, Mich.

OGDEN, C. F., Assistant Purchasing Agent, The Detroit Edison Co., 2000 Second Ave., Detroit 26, Mich.

New York District

INDUSTRIAL INSTRUMENTS, INC., B. O. Weinschel, Chief Electrical Engineer, 17 Pollock Ave., Jersey City 5, N. J.

METAL TEXTILE CORP., O. H. York, Chemical Engineer, 4 Central Ave., Orange, N. J.

NEW YORK PRODUCE EXCHANGE, M. Lauro, Chief Chemist, 2 Broadway, New York 4, N. Y.

WESTINGHOUSE ELECTRIC ELEVATOR CO., L. E. Day, Materials Engineer, 150 Pacific Ave., Jersey City 4, N. J.

BLOOM, SAMUEL A., Chemist, Titanium Pigment Corp., 99 Hudson St., New York, N. Y. For mail: 67–70 Yellowstone Blvd., Apt. 4 V, Forest Hills, L. I., N. Y.

CARBONE, JOSEPH, Junior Research Engineer, Republic Aviation Corp., Farmingdale, L. I., N. Y. For mail: 172 Seventeenth St., Brooklyn 15, N. Y. [J]

COLLIN, MARVIN B., Chemical Engineer, Metaplast Co., 205 W. Nineteenth St., New York, N. Y. For mail: 156 Wilson St., Brooklyn 11, N. Y. [J]

EICHWALD, ERIC, Chief Chemist, Arrow Laboratories, Inc., 152 W. Twenty-fifth St., New York 1, N. Y. For mail: 1815 Riverside Dr., New York 34, N. Y.

FLOERSHEIM, WERNER, Textile Consultant, Werner Textile Consultants, Inc., 60 E. Forty-second St., New York, N. Y. For mail: 115-25 Metropolitan Ave., Kew Gardens, L. I., N. Y.

GIOTTA, ANTHONY J., Junior Research Engineer, Republic Aviation Corp., Farmingdale, L. I., N. Y. For mail: 825 Neill Ave., New York 60, N. Y. [J]

GRAHAM, R. RUSSELL, Assistant Division Engineer, American Bridge Co., 71 Broadway, New York 6, N. Y.

HAYNE, WILLIAM G., Supervising Engineer, Bureau of Fire Prevention and Water Supply, New York Board of Fire Underwriters, 85 John St., New York 7, N. Y.

KENDE, STEPHEN, Chemist, H. W. Baker Linen Co., 315 Church St., New York 13, N. Y.

MINER, R. S., Research Chemist, Tung-Sol Lamp Works, Inc., 95 Eighth Ave., Newark 4, N. J.

NASH, C. A., Consulting Chemist, Bakelite Corp., 230 Grove St., Bloomfield, N. J. For mail: 209 Mountain Ave., N. Caldwell, N. J.

NECHAMKIN, H., Chief Chemist, Hazeltine Electronics Corp., 58-25 Little Neck Parkway, Little Neck, N. Y.

SCHWEIZER, ERNEST, Physicist, Celanese Corporation of America, Plastics Division, 290 Ferry St., Newark 5, N. J.

TAYLOR, A. LLOYD, Director of Research, Oakite Products, 22 Thames St., New York 6, N. Y.

Northern California District

TWIST, G. F., Vice-President, Atlas Imperial Diesel Engine Co., 1000 Nineteenth Ave., Oakland 6, Calif.

Philadelphia District

ASSOCIATION OF AMERICAN RAILROADS, Washington, D. C. A. R. Wilson, Standards Representative Engineer of Bridges and Buildings, The Pennsylvania Railroad Co., Room 450, Thirtieth Street Station, Philadelphia 4, Pa.

NORTH AMERICAN SMELTING CO., Edw. J. Ferguson, Vice-President, Tioga and Edgemont Sts., Philadelphia 34, Pa.

YORK SAFE AND LOCK CO., E. F. Green, Chief Engineer, Loucks Mill Rd., York, Pa.

CLINE, WILLIAM M., JR., Combustion Engineer, Bethlehem Steel Co., Construction Engineering Dept., Bethlehem, Pa.

MAZIA, JOSEPH, Metallurgist, Frankford Arsenal, Philadelphia, Pa. For mail: 1625 S. Fifty-eighth St., Philadelphia 43, Pa.

MCCANN, E. J., General Works Manager, South Chester Tube Co., Front and Thurlow Sts., Chester, Pa.

ROTHKOPF, HYMAN D., Textile Technologist, U. S. Test Lab., Bldg. 121, Philadelphia Navy Yard, Philadelphia, Pa. For mail: 1309 Spruce St., Philadelphia 7, Pa.

Pittsburgh District

FLECK, R. G., Metallurgist, Electricweld Tube Div., Jones & Laughlin Steel Corp., 363 Seneca St., Oil City, Pa.

GUTKIN, S. S., Technical Director, Falk and Co., Box 1075, Pittsburgh, Pa.

HILL, ERLE G., Director of Metallurgy and Development, Wheeling Steel Corp., Wheeling, W. Va.

JUDKINS, MALCOLM F., Chief Engineer, Firthite Division, Firth-Sterling Steel Co., McKeesport, Pa. For mail: 1203 Summit St., McKeesport, Pa.

St. Louis District

HANGER, K. H., Chief Engineer, Missouri-Kansas-Texas Lines, 1526 Railway Exchange Bldg., St. Louis 1, Mo.

MAGRUDER, W. C., JR., Chief Chemist and Metallurgist, Carter Carburetor Corp., 2840 N. Spring St., St. Louis 7, Mo.

Southern California District

PRECO, INC., E. F. Stoner, Chief Engineer, 960 E. Sixty-first St., Los Angeles 1, Calif.

RYAN AERONAUTICAL CO., Hayden Gordon, Assistant Chief of Development, 2701 Harbor Dr., San Diego 12, Calif.

Western New York-Ontario District

HAYES STEEL PRODUCTS, LTD., W. D. Carruthers, Factory Manager, Merritton, Ont., Canada.

ESTES, ROBERT C., Superintendent of Quality Control, Hewitt Rubber Corp., 240 Kensington Ave., Buffalo 5, N. Y.

GENTILE, J., District Manager, Pittsburgh Testing Laboratory, 257 Franklin St., Buffalo 2, N. Y.

THORNTON, J. S., General Foreman, Experimental Dept., The De Havilland Aircraft Co., Ltd., Toronto, Ont., Canada. For mail: 1514 Dufferin St., Toronto, Ont., Canada.

U. S. and Possessions

OTHER THAN A.S.T.M. DISTRICTS

CAPE ANN ANCHOR AND FORGE CO., A. H. Nutton, Assistant General Manager, Whittemore St., Gloucester, Mass.

COMPO SHOE MACHINERY CORP., T. T. Taylor, Technical Director, 150 Causeway St., Boston 14, Mass.

EASTERN STAINLESS STEEL CORP., H. S. Schaufus, Chief Metallurgist, Box 1975, Baltimore 3, Md.

EL PASO TESTING LABORATORIES, Mrs. George Millar, Director, Box 1565, El Paso, Tex.

GREAT SOUTHERN BOX CO., INC., Box 324, New Orleans 9, La.

HOUDAILLE-HERSHEY CORP., Herbert S. Jandus, Chief Engineer, 2188 National Bank Bldg., Detroit 26, Mich.

SHAW LABORATORIES, C. D. Shaw, Owner, Macedonia, Ohio.

WATERBURY AND SONS CO., H., Fred E. Parkinson, Superintendent, Oriskany, N. Y.

AMES, CITY OF, J. H. Ames, City Manager, City Hall, Ames, Iowa.

BECKETT, RUSSELL V., Materials and Process Engineer, Westinghouse Electric and Manufacturing Co., 2519 Wilkens Ave., Baltimore 3, Md. For mail: 605 N. Chapelgate Lane, Baltimore 29, Md.

BENNETT, J. W., Chief Engineer, Western Massachusetts Electric Co., 73 State St., Springfield 2, Mass.

DAVIS, ALFRED SHERMAN, JR., Service Engineer, Combustion Engineering Co., Inc., 200 Madison Ave., New York 16, N. Y. For mail: 560 Chestnut St., Waban, Mass.

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FOX, JEFF S., Airways Engineer, Civil Aeronautics Administration, Box 1689, Fort Worth, Tex. For mail: 723 E. Mulkey St., Fort Worth 3, Tex.

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GOLEMBE, STANLEY NORMAN, Staff Member, Massachusetts Institute of Technology, Cambridge, Mass. For mail: 111 Gainsborough St., Boston 15, Mass. [J]

HESS, WENDELL F., Associate Professor in Metallurgical Engineering, and Head of

* [J]—Denotes Junior Member.

Welding Lab., Rensselaer Polytechnic Inst., Troy, N. Y.

INDIANA UNIVERSITY LIBRARY, Bloomington, Ind.

JEFFERSON, C. W., Asphalt Engineer, Oklahoma State Highway Dept., Oklahoma City, Okla. For mail: 1420 SW 24th St., Oklahoma City 8, Okla.

JOHNSTONE, ARTHUR LELAND, Chief Chemist, Consumers Cooperative Assn., 1500 Iron St., North Kansas City 16, Mo. [J]

KUENZI, EDWARD W., Civil Engineer, U. S. Forest Products Laboratory, Madison 5, Wis.

LASHBROOK, C. A., President, Oklahoma Testing Laboratories, Box 1982, Oklahoma City, Okla.

LILLYBLAD, ROBERT H., Partner in Charge of Manufacturing and Engineering, Camfield Manufacturing Co., 718 N. Seventh St., Grand Haven, Mich.

MARTIN, GUY V., Owner, Martin Laboratories, 110 S. Yale Ave., Albuquerque, N. Mex.

MILLER, THEODORE T., General Sales Manager, Dewey & Almy Chemical Co., 62 Whittemore Ave., Cambridge 40, Mass.

PAULSON, HAAKON, Vice-President, Besser Manufacturing Co., Alpena, Mich. For mail: 507 State Ave., Alpena, Mich.

PICARD, D. C., The Picard Testing Laboratories, Inc., 2920 Seventh Ave. S., Birmingham 1, Ala.

ROBERTS, FLOYD, Standards Specialist, Office of Price Administration, Washington, D. C. For mail: 1902 Lansdowne Way, Silver Spring, Md.

STEWART, R. JACK, Lubricating Engineer and Laboratory Tester, Stewart Bros. Oils, Inc., Box 1050, El Paso, Tex.

SUSANO, CHARLES D., Superintendent, Bldg. 2714F, Tennessee Eastman Corp., Oak Ridge, Tenn. For mail: 5513 Lake Shore Dr., Knoxville, Tenn.

TYLER, GAINES A., Captain; Chief, Research and Development Div., U. S. Coast Guard, 1300 E St., Washington 25, D. C.

WINTHER, ARTHUR VIGGO, Buyer, Standard Oil Co. of Texas, Box 862, El Paso, Tex.

WISEBLOOD, NATHAN, Chief Testing Engineer, The Hub Testing Laboratory, 145 Cambridge St., Allston, Mass.

YEN, CHIA-SHIANG, Graduate Student, University of Illinois, Urbana, Ill. For mail: 1105 W. Clark St., Urbana, Ill.

Other than U. S. Possessions

IMPERIAL CHEMICAL INDUSTRIES, LTD., WATER TREATMENT BUREAU, The Secretary, Alkali Div., Northwich, Cheshire, England.

LIMMER & TRINIDAD LAKE ASPHALT CO., LTD., THE, A. W. Attwooll, Chief Chemist, Berry Hill, Taplow, nr. Maidenhead, Berks, England.

PIRELLI, S. A., COMPANHIA INDUSTRIAL BRASILEIRA, Rodolpho Ortenblad, Managing Director, Caixa Postal 163-A, São Paulo, Brazil.

SOCIÉTÉ MISR POUR LA FILATURE ET LE TISSAGE, Abdel Rahman Hamada, Managing Director, Mehalla el Kubra, Egypt.

SOUTH AFRICAN RAILWAY HEADQUARTERS, Librarian, Room 6, Technical Library, Johannesburg, South Africa.

BAILEY, GEORGE LEO, Director, British Non-Ferrous Metals Research Assn., 81–91 Euston St., London, N. W. 1, England.

DIAMOND, W. E. DE B., General Manager, British Plastics Federation, 47/48 Piccadilly, London, W. 1, England.

DIRECÇÃO GERAL DA INDÚSTRIA, MINISTÉRIO DE COMÉRCIO E INDÚSTRIA, Praça do Rio de Janeiro 19, Lisbon, Portugal.

LOCK, EVERARD JOHN GRAHAM, Civil Engineer and Surveyor, Messrs. John Mowlem and Co., Ltd., Westminster, England. For mail: 96 Shakespeare Rd., Hanwell, W. 7, London, England.

NATIONAL STANDARDS LABORATORY, Officer in Charge, University Grounds, City Rd., Chippendale, N. S. W., Australia.

ROLLASTON, ERNEST CLARENCE, Director of Research, Murex Welding Processes, Ltd., Waltham Cross, Herts, England.

TECHNICAL COLLEGE, H. Richardson, Principal, Bradford, Yorkshire, England.

VIGERS, T. W., General Manager, Magnesium Metal Corp., Ltd., Port Tennant Works, Swansea, South Wales, England.

WEYGANDT, ARTHUR SCOTT, Technical Director, Industrias Químicas Argentinas "Duperial," Paseo Colon 285, Buenos Aires, Argentina.

Personals . . .

. . . News items concerning the activities of our members will be welcomed for inclusion in this column.

H. McC. LARMOUR, formerly Chief Chemist, Yosemite Portland Cement Corp., Merced, Calif., is now Chemical Engineer, Pacific Portland Cement Co., Redwood City, Calif.

L. A. MEKLER, who was Engineer, Universal Oil Products Co., Chicago, Ill., is now Consultant for the Armour Research Foundation and the Gas Institute, affiliated with the Illinois Institute of Technology, Chicago, Ill.

C. P. MARSH has retired as Assistant Engineer, New York Central Railroad Co., New York, N. Y.

E. I. VALYI is now President, A.R.D. Corp., New York, N. Y. He was Vice-President, Sam Tour and Co., Inc., in New York.

B. L. AVERBACH is now Metallurgist, General Electric Co., Schenectady, N. Y. He was formerly connected with U. S. Radiator Corp., Geneva, N. Y., as Chief Metallurgist.

SAM RUGGERI, formerly Assistant Chemical Engineer, Houdaille-Hershey Corp., Decatur, Ill., is now Assistant Chemical Engineer, The Insl-X Corp., Brooklyn, N. Y.

D. GARDNER FOULKE who was Chief Chemist, Houdaille-Hershey Corp., Decatur, Ill., is now Director, Analytical Laboratory, Foster D. Snell, Inc., Brooklyn, N. Y.

HERBERT S. SCHENKER, Chief of Textiles, Clothing Division, United Nations Relief and Rehabilitation Administration, Washington, D. C., has recently returned from Brazil where on behalf of UNRRA he negotiated the purchase of 45,000,000 yards of cotton textiles for relief purposes, as a part of the contribution of the Government of Brazil to the work of UNRRA.

MEYER CHISDES, formerly Chemist, Lithaloys Corp., Long Island City, N. Y., is now Chemist, Hazeltine Corp., Little Neck, L. I., N. Y.

WILFRED C. SWANKER, formerly Chief Engineer, Acro Electric Co., Cleveland, Ohio, is now President, Troniks, Inc., Cleveland, Ohio.

G. L. MEYERS is now Chemical Engineer, Bareco Oil Co., Box B, Barnsdall, Okla. He was Assistant Professor, Department of Chemical Engineering, Oklahoma Agricultural and Mechanical College.

KALMAN STEINER, formerly Assistant Chief of Production, Twin Cities Office, Chicago Ordnance District, U. S. War Dept., Minneapolis, Minn., is now Consulting Engineer, C. Hoffberger Co., Baltimore, Md.

JOHAN BJORKSTEN is now Industrial Research Chemist, Bjorksten Laboratories, Chicago, Ill. He was formerly Partner, ABC Packaging Machine Co., Quincy, Ill.

E. C. R. SPOONER, who was Technical Superintendent and Assistant General Manager, Magnesium Metal Corp., Ltd., Port Tennant Works, Swansea, South Wales, England, is now Chemical Engineering Consultant, Sutcliffe, Speakman & Co., Ltd., Leigh, Lancashire, England.

WILLIAM FURBER SMITH who was President, Oklahoma Testing Laboratories, Oklahoma City 1, Okla., is now with the Carbide and Carbon Chemicals Corp., 3280 Broadway, New York 27, N. Y.

ELMER H. SNYDER, formerly Research Metallurgist and Engineer, International Harvester Co., Chicago, Ill., is now Chief Metallurgist, Austin-Western Co., Aurora, Ill.

ARTHUR W. F. GREEN, formerly Chief Metallurgist, Pratt & Whitney Aircraft Corp. of Missouri, Kansas City, Mo., is now Chief Metallurgist, Allison Division, General Motors Corp., Indianapolis, Ind.

W. B. LINCOLN, JR., who was on leave of absence from Inland Container Corp., Indianapolis, Ind., where he was Development Engineer, has returned to his duties. He has been with the Packing and Crating Section, Office of Quartermaster General, U. S. Army, Washington, D. C., serving as Principal Supply Specialist.

GEORGE W. WHITESIDES, formerly Technical Director, Solvents and Plastics Co., Louisville, Ky., is now with G. W. Whitesides Co., Louisville, Ky.

FRED J. TOBIAS is now Vice-President, A.R.D. Corp., New York, N. Y. He was with Sam Tour and Co., Inc., in New York.

EDWARD G. MULLEN, formerly Research Chemist, American Reenforced Paper Co., Attleboro, Mass., is now General Manager, W. Ralston Co., Inc., New York, N. Y.

F. W. BRETH, who was Technical Director, is now Vice-President in Charge of Manufacturing, L. Sonneborn Sons, Inc. Petrolia, Pa.

ALLAN L. TARR is now Supervisor, Research Development Laboratories, Revere Copper and Brass Co., Magnesium-Aluminum Division, Baltimore, Md. He was formerly Supervisor, Metallurgical Laboratory, Basic Magnesium, Inc., Henderson, Nevada.

H. P. BIGLER, Executive Vice-President, Connors Steel Co., Birmingham, Ala. presided at ceremonies in February when the company received the Army-Navy E for their outstanding work in connection with fragmentation bomb casings. The award was received by GEORGE W. CONNORS, JR., company President.

Two A.S.T.M. members were honored recently by the American Foundrymen's Association: ROBERT E. KENNEDY, Executive Vice-President and Secretary, American Foundrymen's Association, an Honorary Life Membership and the Joseph S. Seaman Gold Medal of A.F.A. "for outstanding meritorious services to all branches of the Foundry Industry through his work in organizing and guiding the development of technical and operating papers and discussions, and his untiring encouragement to all A.F.A. chapters, committees and members;" and RALPH J. TEETOR, President, Cadillac Malleable Iron Co., Cadillac, Mich., President of the A.F.A., 1944–1945, received an Honorary Life Membership in A.F.A.

RALPH T. K. CORNWELL, Director of Research, Sylvania Industrial Corp., Fredericksburg, Va., has been elected to the Board of Directors of that company.

ALWIN C. EIDE, Manager, Pigment Division, American Zinc Sales Co., Columbus, Ohio, has been elected a vice-president of the American Zinc Sales Co., and the American Zinc Oxide Co., subsidiaries of the American Zinc, Lead and Smelting Co. His offices are in Columbus.

MACY O. TEETOR, Executive Engineer, Perfect Circle Co., Hagerstown, Ind., has been elected vice-president of the fuels and lubricants activity of the Society of Automotive Engineers. During Mr. Teetor's temporary leave of absence due to illness, fuels and lubricants activity will be managed by DR. J. C. GENIESSE, Research Chemist, The Atlantic Refining Co., Philadelphia, Pa.

E. KVET, Technical Director, Baldwin Rubber Co., Pontiac, Mich., has been elected Secretary of the Detroit Rubber and Plastics Group.

HARRISON F. GONNERMAN, Manager, Research Laboratory, Portland Cement Association, Chicago, Ill., received the annual award of the Wasón Medal of the American Concrete Institute for "Noteworthy Research" reported in the ACI Proceedings, Vol. 40 in the work reported in his paper "Tests of Concrete Containing Air-entraining Portland Cements or Air-entraining Materials Added to Batch at Mixer." The award was made at the luncheon meeting of the American Concrete Institute, New York, on February 16.

The sixteenth James Douglas Gold Medal award of the American Institute of Mining and Metallurgical Engineers this year went to ROBERT FRANKLIN MEHL, Director, Metals Research Laboratory and Head, Department of Metallurgy, Carnegie Institute of Technology, Pittsburgh, Pa., for "distinguished achievement in physics and physical metallurgy; and especially for his development of gamma-ray radiography and for conspicuous success in his metallurgical investigations involving diffusion and crystal structures."

E. CHESTER WRIGHT, Assistant to the President, National Tube Co., Pittsburgh, Pa., was selected to receive the 1945 Robert W. Hunt Silver Medal and Certificate for his paper, "The Manufacture and Properties of Killed Bessemer Steel," presented in February, 1944.

News Notes on Organizations Furnishing Testing and Scientific Equipment and Testing Services

EDITOR'S NOTE.—From time to time this column will include notes on items that would be of interest to the members concerning activities of companies which manufacture or distribute testing and scientific equipment and news on professional testing laboratories.

C. J. TAGLIABUE MFG. CO. has become the C. J. Tagliabue Division of Portable Products Corp., this announcement having been received in January. The business is to be operated as a separate division and with the present research and development policies continued. R. M. WILHELM, Technical Adviser, who represents the company's membership in A.S.T.M., and who is very active in the Society's work, has his office at 1 Hanson Place, Brooklyn 5, N. Y. The company's manufacturing facilities continue at the plant, Park and Nostrand Aves.

SONNTAG SCIENTIFIC CORP., 15 Seneca Place, Greenwich, Conn., announces the opening of a modern commercial testing laboratory for fatigue and vibration research. The laboratory includes up-to-date testing equipment for tension, fatigue, dynamic testing, compression, bending and torsion.

"SCOTT TESTERS, INC." is the new firm name of Henry L. Scott Co., Providence, R. I., manufacturers of testing machines. In announcing the change, Mr. David C. Scott, President and Treasurer, states "The change is one of name only, and is made to better describe our firm in relation to the equipment it manufactures."

H. H. Morgan on A.S.A. Board

ON NOMINATION by the Society, H. H. Morgan, Chief Engineer Robert W. Hunt Co., Chicago, Ill., has been elected a new member of the Board of Directors of the American Standards Association. Two other new members are George H. Taber, Jr., President, Sinclair Refining Co., New York, N. Y. (A.P.I. nominee), and Frederick R. Lack, Vice-President and Manager, Radio Division, Western Electric Co., Inc., New York, N. Y. (I.R.E. nominee). A past-president of the Society, Mr. Morgan has been extremely active for many years in A.S.T.M. work and served on the A.S.A. Standards Council, its Mechanical Standards Committee, and other A.S.A. groups.

NECROLOGY

F. C. HOUGHTEN, Lieutenant Commander, U.S.N.R., Research Division, Bureau of Medicine and Surgery, Washington, D. C. Member since 1940. Quite active in Committee C-16 on Thermal Insulating Materials where his very broad technical knowledge of heating, ventilating, and related problems was most helpful in advancing the committee's work, has served as Chairman of the Joint Committee on Thermal Conductivity. He had been Director of the American Society of Heating and Ventilating Engineers' Research Laboratory for almost 20 years. In 1944, at its 50th Annual Meeting, he was given the ASHVE highest honor, the F. Paul Anderson Medal. He had written extensively and participated in the A.S.T.M. Symposium on Thermal Insulating Materials published in 1939. Besides Mrs. Houghten and a daughter three sons survive, two in the Army Air Forces (one a prisoner of war in Germany), and one in the U. S. Maritime Service.

W. S. MOREHOUSE, President, Morehouse Machine Co., York, Pa. Member since 1926. Almost certainly a senior from the standpoint of age of those in the testing machine and scientific instrument field, Mr. Morehouse was noted for the production of proving rings for testing machines, these being distributed throughout the world. Not an active committee member of the Society, Mr. Morehouse nevertheless had been a loyal member and contributed in various ways to the advancement of the Society's work.

E. F. KELLY, Secretary, American Pharmaceutical Assn., Washington, D. C.

LEON CHARLES PICARD, Chemical and Testing Engineer, The Picard Testing Laboratories, Inc., Birmingham, Ala. Captain Picard, who had been a junior member of the Society since 1941, lost his life serving his country in the Central Pacific area. His membership in A.S.T.M. will be carried on by his father, D. C. Picard.

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